

**Fishery Data Series No. 13-20**

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# **Sonar Enumeration of Pacific Salmon Escapement into the Nushagak River, 2007**

**by**

**Gregory B. Buck**

**and**

**Charles E. Brazil**

**May 2013**

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**Alaska Department of Fish and Game**

**Divisions of Sport Fish and Commercial Fisheries**



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<b>Weights and measures (metric)</b>		<b>General</b>		<b>Mathematics, statistics</b>	
centimeter	cm	Alaska Administrative	AAC	<i>all standard mathematical signs, symbols and abbreviations</i>	
deciliter	dL	Code		alternate hypothesis	H <sub>A</sub>
gram	g	all commonly accepted	e.g., Mr., Mrs., AM, PM, etc.	base of natural logarithm	e
hectare	ha	abbreviations		catch per unit effort	CPUE
kilogram	kg			coefficient of variation	CV
kilometer	km	all commonly accepted	e.g., Dr., Ph.D., R.N., etc.	common test statistics	(F, t, $\chi^2$ , etc.)
liter	L	professional titles		confidence interval	CI
meter	m		@	correlation coefficient	R
milliliter	mL	at		(multiple)	
millimeter	mm	compass directions:		correlation coefficient	
		east	E	(simple)	r
		north	N	covariance	cov
		south	S	degree (angular)	°
		west	W	degrees of freedom	df
		copyright	©	expected value	E
		corporate suffixes:		greater than	>
		Company	Co.	greater than or equal to	≥
		Corporation	Corp.	harvest per unit effort	HPUE
		Incorporated	Inc.	less than	<
		Limited	Ltd.	less than or equal to	≤
		District of Columbia	D.C.	logarithm (natural)	ln
		et alii (and others)	et al.	logarithm (base 10)	log
		et cetera (and so forth)	etc.	logarithm (specify base)	log <sub>2</sub> , etc.
		exempli gratia		minute (angular)	'
		(for example)	e.g.	not significant	NS
		Federal Information		null hypothesis	H <sub>0</sub>
		Code	FIC	percent	%
		id est (that is)	i.e.	probability	P
		latitude or longitude	lat. or long.	probability of a type I error	
		monetary symbols		(rejection of the null hypothesis when true)	α
		(U.S.)	\$, ¢	probability of a type II error	
		months (tables and		(acceptance of the null hypothesis when false)	β
		figures): first three		second (angular)	"
		letters	Jan,...,Dec	standard deviation	SD
				standard error	SE
		registered trademark	®	variance	
	AC	trademark	™	population	Var
	A	United States		sample	var
	cal	(adjective)	U.S.		
	DC	United States of	USA		
	Hz	America (noun)	United States		
	hp	U.S.C.	Code		
	pH	U.S. state	use two-letter		
			abbreviations		
			(e.g., AK, WA)		
volts	V				
watts	W				

***FISHERY DATA SERIES NO. 13-20***

**SONAR ENUMERATION OF PACIFIC SALMON ESCAPEMENT INTO  
THE NUSHAGAK RIVER, 2007**

by

Gregory B. Buck and Charles E. Brazil

Alaska Department of Fish and Game, Division of Commercial Fisheries, Anchorage

Alaska Department of Fish and Game  
Division of Sport Fish, Research and Technical Services  
333 Raspberry Road, Anchorage, Alaska, 99518-1565

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*Gregory B. Buck and Charles E. Brazil*  
*Alaska Department of Fish and Game, Division of Commercial Fisheries,*  
*333 Raspberry Road, Anchorage, Alaska 99518, USA*

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## ABSTRACT

Hydroacoustic techniques were used to develop escapement estimates of sockeye *Oncorhynchus nerka*, Chinook *O. tshawytscha*, and chum *O. keta* salmon for the Nushagak River in Bristol Bay, Alaska from 4 June through 19 July, 2007. A standard range dual frequency identification sonar (DIDSON) was used to estimate salmon escapement on the left (south) bank, and a long range DIDSON was used to estimate salmon escapement on the right (north) bank. Estimates of species, age, sex, and size composition were derived from samples obtained with drift gillnets and a beach seine at the sonar site. Final escapement estimates through 19 July were 518,041 sockeye, 60,459 Chinook, and 161,483 chum salmon. Timing of the sockeye salmon escapement was 2 days later than the 2000–2006 average, while Chinook escapement was 4 days later and chum escapement was 1 day later. Sockeye salmon age classes were 1.3 (66.6%), 1.2 (19.9%), and 1.4 (9.5%). The major age classes for Chinook salmon were 1.3 (28.3%), 1.4 (22.5%), and 1.2 (46.6%).

Key words: Pacific salmon *Oncorhynchus*, sockeye salmon *O. nerka*, Chinook salmon *O. tshawytscha*, chum salmon *O. keta*, DIDSON, sonar, Nushagak River, Bristol Bay, escapement, estimation, fisheries management

## INTRODUCTION

The purpose of this study was to estimate escapement of 3 species of Pacific salmon *Oncorhynchus* spp. to the Nushagak River in Bristol Bay, Alaska: sockeye (*O. nerka*), Chinook (*O. tshawytscha*), and chum (*O. keta*). Escapement estimates are used to assess daily run strength and provide escapement goal information that is critical to the management of commercial salmon fishing in Nushagak District.

Nushagak River escapements were initially estimated using aerial surveys in 1956 (Nelson 1987). In 1979, the Alaska Department of Fish and Game (ADF&G) examined the feasibility of using side-scanning sonar (hydroacoustic) equipment on the Nushagak River near the village of Portage Creek. This system evolved into the Bendix sonar system which became the salmon enumeration tool used for this task over the next several decades (McBride 1981). While aerial surveys continued to be flown during the early years of sonar enumeration, eventually, the Nushagak River sonar project evolved to the point that it became the sole basis for salmon escapement information. An independent estimate of sockeye salmon passage was made in 2006 which yielded an estimated passage at the village of Ekwok (approximately 40 miles upriver from the sonar site), of 558,852 fish, which compares favorably with the sonar estimate of 548,410 fish across a very similar time frame (Daigneault et al. 2007). Around the turn of the century, concerns over the increasingly difficult upkeep of this aging system led ADF&G to consider more modern hydroacoustic technologies.

Robertson (1984) used scale pattern analysis to determine that the majority (93%) of sockeye salmon migrating past Portage Creek were native to the watershed while Daigneault et al. (2007) identified the Nuyakuk, King Salmon and Koktuli rivers as major spawning destinations of sockeye salmon in this watershed. In addition, recent genetics results indicate at least 90% of sockeye salmon migrating past the sonar site were from the Nushagak River watershed (Dann et al. 2009). It appears therefore, that very few fish encountered at the project site are strays from other rivers that might back out of the river or migrate back downstream at a later date.

In 2002, ADF&G tested the feasibility of a standard range (SR) dual frequency identification sonar (DIDSON) to evaluate its capability as a viable replacement for the existing Bendix counters (Maxwell and Gove 2004; Burwen et al. 2007). Originally developed by the University of Washington, Applied Physics Laboratory to allow divers to identify mines in turbid waters, the DIDSON creates video-like images (Belcher et al. 2001, 2002). The DIDSON's small pulse

widths, high frequency, and extremely small multiple beams create identifiable fish targets even when more than one fish is in the beam. The higher-than-standard frequency waves reflect off the entire surface of the fish as opposed to only the acoustically “hard” swim bladder. This creates an actual image of the fish that can be counted on a video feed whereas the Bendix sonar simply uses the echo return strength to estimate how many fish are in the beam.

During the 2003 and 2004 field seasons, the SR DIDSON was deployed on the left (south) bank (facing downriver) of the Nushagak River in a comparative study alongside the Bendix (Maxwell et al. 2011). In addition to its ability to produce high resolution images, the DIDSON has a unique acoustic lens system that allows the beam to be focused at different ranges by altering the frequency. The SR DIDSON was operated at 2 frequencies, 1.80 MHz with range settings to 10 m and 1.10 MHz with coverage out to 36 m, providing approximately the same coverage as the Bendix sonar counter.

In 2004 and 2005, a newly developed long range (LR) DIDSON was operated upstream of the Bendix counter on the right (north) bank (facing downriver) alongside the Bendix (Brazil 2008; Maxwell et al. 2011). The LR DIDSON operates at 2 frequencies: 1.20 MHz which allows identification of targets out to 20 m and 0.70 MHz which allows identification of targets out to 60 m. This provided greater river coverage than the Bendix. The escapement estimates used for management on the left bank have been made using the SR DIDSON beginning in 2005 and using a LR DIDSON on the right bank beginning in 2006. Periodically, Bendix sonar equipment has been operated alongside these DIDSON units for the purposes of gathering comparison data.

In addition to estimating the total number of salmon migrating upstream, an accurate estimate of the species composition, age composition, and size/sex for each species is needed to manage towards species-specific management plans and forecast future returns. Species are apportioned by drifting a suite of various sized gillnets in the ensonified area of the river and estimating catch per unit effort (CPUE) for each species. This basic direct sampling approach has been modified numerous times over the years. Brannian et al. (1995) evaluated escapement sampling and associated species apportionment methods used on Nushagak River during 1991 and compared them with methods used on the Lower Yukon River. Based on their review, new methods of estimating Nushagak River salmon passage by species were incorporated in 1992 (Miller et al. 1994a). The method used from 1992 through 2001 created a situation where preliminary species composition estimates were only made after 100 salmon were caught. After 100 salmon were caught, the preliminary species composition estimates were retroactively applied to the escapement count during the season. This created a situation where numerous inseason changes were made to the escapement estimates during the season. This delay caused management concern about the ability to detect rapid shifts in species composition in a manner timely enough to allow management to react. An internal simulation analysis determined in 2002 that using a sample size of 5 fish to estimate species composition during a report period had minimal effects on the daily estimates, was less biased, and more accurate (McKinley 2003). This method has the advantage of providing almost daily estimates of escapement without retroactive changes. One downside to the reduction in sample size from 100 fish to 5 fish was the increase in variance estimates for the species composition estimates. Scale and size/sex sampling is accomplished concurrently with species apportionment sampling.

## **OBJECTIVES**

The project objectives in 2007 were to:

1. Estimate the number of adult sockeye, Chinook, and chum salmon in the Nushagak River from early June through late July such that the escapement estimates were within +/- 10% of the true value 90% of the time. This was accomplished by combining the estimate of the number of salmon-sized hydroacoustic targets passing through the sonar beam(s) with the species composition estimate derived from test fishing with drift gillnets.
2. Estimate the proportion of each of the major sockeye salmon age classes (1.2, 2.2, 1.3, 2.3, 1.4) in the Nushagak River to within 5% of the true proportion 90% of the time.
3. Estimate the sex compositions of the escapements of sockeye, Chinook, and chum salmon in the Nushagak River.
4. Estimate the mean length by age of sockeye, Chinook, and chum salmon in the Nushagak River escapement.

In addition to these objectives, several tasks were accomplished in 2007:

- a) Record daily weather observations (temperature, precipitation, water clarity, etc.) at the sonar site.
- b) Collect DNA tissue samples from sockeye and Chinook salmon as part of the stock-specific sampling plan implemented by ADF&G Gene Conservation Laboratory.

## **METHODS**

### **STUDY SITE**

The Nushagak River is located in Southwestern Alaska and flows approximately 390 km from its headwaters to Bristol Bay (Figure 1). The Nushagak drainage has 2 main tributaries: the Nuyakuk River, draining Tikchik Lakes, which enter from the west, and the Mulchatna River, which flows into the Nushagak from the east. These rivers support large runs of 5 species of Pacific salmon (Table 1) as well as several resident species that are harvested in commercial, sport and subsistence fisheries.

The project site is located on the lower Nushagak River, approximately 40 km upstream from the terminus of the Nushagak commercial fishing district and 4 km downstream from the village of Portage Creek (Figure 1). At the project site, the Nushagak River is contained to one 300 m wide channel, with the exception of one very small slough behind the camp. The site is within the range of tidal influence. While high tide causes a reduction in current, flow reversals rarely occur. Fish actively migrate past the project site and few fish are observed milling in the area.

### **PROJECT DATES**

Project operation dates have varied over the years. In 2007, counts terminated on 19 July. Historically (since 1990) about 97% of the cumulative sockeye salmon passage has occurred by this date. Through 2004, with the exception of 1992 and 2003, operational dates extended to at least 16 August each season to include the majority of the run for all salmon species. In 1992, the project terminated on 22 July due to budget shortfalls. Similarly, in 2003 the project terminated on 20 July, a date that historically includes about 98% of the cumulative sockeye salmon

passage. In 2004, the Bristol Bay Science and Research Institute provided funds that allowed the project to extend to 18 August which provided a more accurate estimate of the later running coho salmon *O. kisutch*. Due to continuing budget constraints, it is not anticipated that project operation dates will extend past 20 July in future years.

## HYDROACOUSTIC ESTIMATES

### SR DIDSON: Left Bank

The left bank SR DIDSON was deployed with a Hydroacoustics Technology Inc.<sup>1</sup> automated, single-axis rotator, and a BioSonics internal attitude sensor that provided heading, pitch, and roll data in 1 s intervals. The DIDSON was affixed to the rotator that was mounted on the cross piece of an aluminum “H-shaped” mount. This assembly was placed in the river such that the DIDSON transducer was entirely submerged at low water with approximately 0.19 m (7.5 inches) clearance between the bottom of the lens and river bottom to allow for pitch adjustment. Orientation for the best image was obtained by adjusting the heading manually while the mounting assembly was leveled with a bubble level. Target testing was conducted with a tungsten steel ball passed through the sonar beam vertically and horizontally to identify the effective detection envelope. Adjustments were made autonomously to pitch, or manually to heading, to maximize the detection envelope.

Once the transducer was properly emplaced, a picket weir was constructed from the shore to just beyond the transducer on both riverbanks using pipe, aluminum angle, and plastic fencing. This prevented fish from passing behind the transducers or within approximately 1 m of the transducer face, a distance at which the system may not detect fish.

Data were streamed via wireless connection from the left bank to the sonar operations tent on the right bank where it was handled on a dedicated laptop. Sonar files were recorded to an external hard drive. Left bank DIDSON counts were performed for 10 min each hour in 2 strata: (1) inshore, 1–10 m, and (2) offshore, 10–30 m.

### LR DIDSON: Right Bank

Assembly, deployment, and testing of the LR DIDSON occurred in a manner similar to that used on the left bank. The LR DIDSON was physically cabled to a dedicated laptop in the operations tent. Sonar files were recorded to an external hard drive. Right bank DIDSON counts were performed for 10 min each hour in 2 strata: (1) inshore, 1–10 m, and (2) offshore, 10–50 m.

### DIDSON: Counting Fish on DIDSON (Playback of files)

The DIDSON software program was used to programmatically capture one 10 min file using inshore settings and one 10 min file using offshore settings on each bank each hour. Equipment settings and timing of file record events were controlled using software specifically designed for DIDSON operations. Frame rates were set as high as the system would allow without dropping significant numbers of frames during recording sessions (generally between 3 and 8 frames per second). Recordings were made using an intensity setting of 90, and threshold setting of 10, with auto-frequency, smoothing, and default focus enabled.

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<sup>1</sup> Product names used in this report are included for scientific completeness, but do not constitute a product endorsement.

Playback of the hourly 10 min files for inshore and offshore strata was completed soon after they were recorded throughout the day, or early morning in the case of files recorded overnight. Missing counts were interpolated by averaging counts 2 hours before and 2 hours after the missing counts. Entering the 10 min counts provided an accurate cross check of each day's hourly counts by stratum. Backup files were maintained on CDs.

## SPECIES COMPOSITION SAMPLING

Daily sonar counts were apportioned among salmon species based on test fish catches collected with 18.3 m (10 fathom) drift gillnets with mesh sizes of 20.6 cm (8.125 in), 15.2 cm (6.0 in), and 13.0 cm (5.125 in). All gillnets were composed of mono twist filament webbing dyed Tairyō shade #T-14 (a translucent light green). Twine size was dependent upon mesh size, with 13.0 cm and 15.2 cm mesh gillnets having a Tairyō #12 twine size, and 20.6 cm mesh gillnets having a Tairyō #18 twine size. Gillnet depth was 45 mesh (approximately 4–5 m deep) for the 13.0 cm mesh gillnets, 45 cm mesh for the 15.2 cm mesh gillnets, and 29 mesh (approximately 5–6 m deep) for the 20.6 cm mesh gillnets. These depths were selected to sample the entire water column.

Test fishing was conducted just downstream of the transducers so that catches would be as representative as possible of the migrating stream of fish passing through the ensonified zone. Because of the possibility that species composition may differ with respect to distance from shore, as well as between river banks, the river was divided into 4 separate strata (left inshore, left offshore, right inshore, and right offshore). Inshore drifts started with one end on the bank, while offshore drifts started with the inshore end of the net deployed 10 m from shore.

During the period of peak sockeye salmon passage (from 18 June through 13 July), drift sessions were conducted 3 times daily: morning (0800–1100 hours), mid-day (1300–1600 hours), and evening (1800–2100 hours). Prior to 18 June, and after 13 July, drift sessions were conducted twice daily: mid-morning (0800 to 1100 hours) and early evening (1600–1900 hours). During each drift session, each mesh size was fished for a targeted time of 2.5 minutes per drift. During periods of high catches, drift times were shortened. Drifts were not conducted at night for safety reasons. Six drifts per day were conducted with each mesh size and strata during periods of peak passage or 4 drifts per day, peak and strata during off-peak periods.

## SPECIES COMPOSITION ESTIMATES

The daily escapement estimate by species was calculated by applying the CPUE generated through test fishing to the sonar counts for each stratum. The test fishing unit of effort was catch per fathom-hour.

While gillnets are very selective, Miller et al. (1994b) and Miller (1995) found no discernible size selectivity for sockeye, Chinook, or chum salmon with 13.0 cm and 15.2 cm mesh gillnets. The 20.6 cm mesh gillnet, however, tended to select for large sockeye and chum salmon. Therefore, only 13.0 cm and 15.2 cm mesh data were used to apportion sockeye and chum salmon, while data from all 3 mesh sizes (13.0 cm, 15.2 cm, and 20.6 cm) were used to apportion Chinook salmon (Brannian et al. 1995).

To estimate fishing effort, we measured fishing time ( $FT$ ) to the nearest second and recorded it in decimal minutes. We calculated each drift as

$$FT = RI - FD , \quad (1)$$

where  $FD$  was the point in time when the net was fully deployed and  $RI$  was the point in time when net retrieval began. The number of fathom-hours ( $FH$ ) was

$$FH = \frac{f FT}{60} , \quad (2)$$

where  $f$  was net length in fathoms (generally 10). The CPUE for each salmon species (group) was based on a specific subset of gillnet mesh sizes, specified above. The CPUE for each species ( $i$ ) during session  $j$  in stratum  $k$  was calculated by summing the number caught ( $C_{ijkmn}$ ) across mesh size ( $m$ ) and drift ( $n$ ):

$$CPUE_{ijk} = \frac{\sum_{m=1}^3 \sum_{n=1}^6 u_{im} C_{ijkmn}}{\sum_{m=1}^3 \sum_{n=1}^6 u_{im} FH_{jkmn}} , \quad (3)$$

where  $u_{im}$  equals 1 if species  $i$  from mesh  $m$  is used to estimate species composition, and  $u_{im}$  equals 0 otherwise.

The CPUE was summed across drift sessions to create a time and area stratified estimate of species composition. The duration of a time stratum (report period) varied by range and bank and was specified as an input file. The minimum sample size for each time-area stratum was 5 salmon. The rational for the 5 fish minimum sample size was outlined in Brazil (2008; Appendix D1). If less than 5 salmon were captured during a day in an area stratum, catches from previous days (all mesh sizes) were added until the minimum sample size was met. The CPUE of species  $i$  in period  $t$  and stratum  $k$  was the sum across all days  $j$ :

$$CPUE_{itk} = \sum_{j=1}^{j^k} CPUE_{ijk} . \quad (4)$$

The proportion of species  $i$  for report period  $t^k$  and area stratum  $k$  ( $S_{itk}$ ) was estimated by:

$$\hat{S}_{itk} = \frac{CPUE_{itk}}{\sum_{i=1}^5 CPUE_{itk}} . \quad (5)$$

To estimate the variance, we assumed that the number of each species caught has a multinomial distribution. Because sampling effort was fairly constant for all drifts within each time period

and area stratum, sample size was equal to the total number of fish caught during a time period within an area stratum. The variance of  $\hat{S}_{itk}$  was

$$Var(\hat{S}_{itk}) = \frac{\hat{S}_{itk}(1 - \hat{S}_{itk})}{C_{ik} - 1}. \quad (6)$$

Ideally, we would have stratified the estimates of species proportion by drift session (2 or 3 drift sessions per time period). Unfortunately, sample sizes were often too small (<5 fish total) to estimate species proportion during each drift session. Therefore, the variance estimate for each time  $t$  and area stratum  $k$  was probably underestimated because it did not include variance by drift session.

## SALMON ESCAPEMENT ESTIMATES

We derived estimates of species escapements and associated variances from the DIDSON system for comparative purposes. Sonar personnel completed one 10 min count per hour per stratum (left bank inshore, left bank offshore, right bank inshore, right bank offshore). The total count ( $\hat{n}_{tk}$ ) for time period  $t$  and stratum  $k$  was:

$$\hat{n}_{tk} = \sum_{h=1}^{h^t} 6\hat{n}_{tkh}, \quad (7)$$

where  $\hat{n}_{tkh}$  was a 10 min count conducted during hour  $h$  within period  $t^k$  and stratum  $k$ . Note that there were  $h^{tk}$  hours in period  $t^k$ .

We expanded 10 min counts into hourly estimates, and estimated variance using Wolter's (1984, 1985) V5 estimator for systematic sampling schemes. This was the least biased and most efficient estimator of variance when estimating salmon escapements with systematic sampling (Reynolds et al. 2007). It was not possible to develop unbiased estimates of variance with a systematic sampling scheme (Cochran 1977; Wolter 1984, 1985) without stratified random sampling which is not feasible in this case because of the limited crew size. The variance was estimated as:

$$Var(\hat{n}_{tkh}) = \frac{(1-f)}{h^{tk}(3.5(h^{tk}-4))} \sum_{h=1}^{h^k} \left( \frac{n_{kh}}{2} - n_{kh-1} + n_{kh-2} - n_{kh-3} + \frac{n_{kh-4}}{2} \right)^2, \quad (8)$$

where  $f$  = sampling rate, leading to:

$$Var(\hat{n}_{ith}) = (6h^{tk})^2 Var(\hat{n}_{ith}). \quad (9)$$

We apportioned sonar counts for each area stratum (left and right bank, inshore and offshore) to species for the period  $t$ . The time period escapement estimates for each salmon species and area stratum ( $\hat{N}_{ith}$ ) were based on estimates of species proportions ( $\hat{S}_{ith}$ ) from escapement sampling and period sonar counts ( $\hat{n}_{ith}$ ) where:

$$\hat{N}_{ith} = \hat{S}_{ith} \hat{n}_{ith}. \quad (10)$$

By summing area strata estimates, time period escapement ( $\hat{N}_{it}$ ) estimates by species were estimated as:

$$\hat{N}_{it} = \sum_{k=1}^4 \hat{N}_{ith}. \quad (11)$$

We followed Goodman (1960) to calculate the variance of  $\hat{N}_{ijk}$ :

$$Var(\hat{N}_{ijk}) = \hat{n}_{ith}^2 Var(\hat{S}_{ith}) + \hat{S}_{ith}^2 Var(\hat{n}_{ith}) - Var(\hat{n}_{ith}) Var(\hat{S}_{ith}). \quad (12)$$

The total variance,  $V(\hat{N}_{it})$ , across all strata was

$$V(\hat{N}_{it}) = \sum_{k=1}^4 Var(\hat{N}_{ith}). \quad (13)$$

We derived cumulative escapement estimates by summing daily estimates, with the total variance equal to the sum of the daily variances.

## AGE, SEX, LENGTH, AND GENETIC SAMPLING

Sonar personnel collected age, sex, and length (ASL) data from sockeye, Chinook, and chum salmon migrating past the sonar site. Prior to 1995, we sampled only sockeye and chum salmon captured with beach seines to avoid size selectivity associated with gillnets (Miller et al. 1994a, 1994b; Miller 1995). However, in 1992, Miller et al. (1994a) found that fish caught with 13.0 cm and 15.2 cm mesh gillnets had length frequency distributions similar to those caught with beach seines, particularly for sockeye salmon caught with 13.0 cm mesh gillnets. Based on this information, we collected sockeye salmon ASL data from fish caught with 13.0 cm and 15.2 cm mesh gillnets, in addition to beach seines, beginning in 1995 (Miller 1996). Between 1996 and

2003, sockeye salmon ASL information was collected only from fish caught with 13.0 cm mesh gillnets and beach seines. Beginning in 2004, sockeye and chum salmon ASL information was collected from fish caught with 13.0 cm and 15.2 cm mesh gillnets. We sampled all captured Chinook salmon regardless of gear type, gillnet mesh size, or catch location to increase sample sizes.

We estimated fish age by examining scales (Mosher 1968). Scales were collected from the left side of the fish approximately 2 rows above the lateral line in an area crossed by a diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin (INPFC 1963). Because of the high rate of scale loss and regeneration among Chinook salmon, 3 scales were sampled per fish. Sockeye and chum salmon were sampled with one scale per fish. Scales were mounted on gummed cards with impressions imbedded in cellulose acetate using a heated press (Clutter and Whitesel 1956). We used European notation, where numerals preceding the decimal refer to the number of freshwater annuli and numerals following the decimal refer to the number of marine annuli (Koo 1962). The total age of a fish, from the time of egg deposition (brood year), was the sum of these two numbers plus one to account for incubation time.

A sampling goal of 480 salmon per stratum allowed us to estimate the proportion of each age class within 5% of the true value 90% of the time (Thompson 1987). This sample size took in to account the approximately 20% of the scales that are regenerated, reabsorbed or otherwise illegible (Tim Baker, Commercial Fisheries Biologist, ADF&G, Anchorage, personal communication). Sampling was stratified by time period (early, middle, and late run) in the case of sockeye salmon. Chinook and chum salmon samples were not stratified by time. Therefore, our season total sampling goals summed to 1,440 sockeye, 480 Chinook, and 480 chum salmon. This level of sampling ensured the objective criteria were met for objectives 3 and 4. Estimates of age composition were compared postseason for sockeye salmon between time strata using a chi-square analysis (Snedecor and Cochran 1980).

We estimated age and sex composition as a series of proportions ( $p_{ias}$ ) of a multinomial distribution of age ( $a$ ), sex ( $s$ ), and species ( $i$ ):

$$\hat{p}_{ias} = n_{ias} / n_{it} , \quad (14)$$

where  $n_{it}$  is the sample counted in period  $t$  and species  $i$  and  $n_{ias}$  is the number of age  $a$  and sex  $s$  counted in period  $t$  by species  $i$ . The marginal proportion for each combination of age and sex, along with estimates of the proportions' variance (Cochran 1977) was estimated as:

$$Var(\hat{p}_{ias}) = \frac{\hat{p}_{ias}(1 - \hat{p}_{ias})}{n_{it} - 1}. \quad (15)$$

We calculated the standard error of length ( $\ell$ ) by species, age, sex, and period of fish sampled in the escapement as:

$$se(\bar{\ell}_{iast}) = \frac{1}{n_{iast}} \sqrt{\frac{\sum_{k=1}^{n_{iast}} (\ell_{iastk} - \bar{\ell}_{iast})^2}{n_{iast} - 1}}, \quad (16)$$

where  $\bar{\ell}_{iast}$  was the mean length of species  $i$ , age  $a$ , sex  $s$ , during period  $t$ , and  $\ell_{iastk}$  represents the length of fish  $k$  of species  $i$ , age  $a$ , sex  $s$ , and period  $t$ , and  $n_{iast}$  was the number of fish of species  $i$ , age  $a$ , sex  $s$ , during period  $t$ . We measured salmon from the mideye to tail fork, and recorded lengths to the nearest 5 mm. In all species, sex was determined from external morphological characteristics.

## MIGRATORY TIMING

We calculated the average daily passage for sockeye, Chinook, and chum salmon using all years of sonar data. Average daily proportions ( $\bar{p}_j$ ) were calculated as the sum of daily proportions ( $p_{ji}$ ) for all years, divided by the total number of years ( $Y$ ):

$$\bar{p}_j = \frac{\sum_{i=1}^Y p_{ji}}{Y}. \quad (17)$$

Average cumulative proportions by day were the sum of average daily proportions through time.

We compared the 2007 run to the desired escapement goal or objective for each species. The average daily cumulative proportions for each species were multiplied by their respective escapement goal or objective as follows: 550,000 for sockeye salmon, the midpoint of the escapement goal range of 340,000–760,000; 75,000 for Chinook salmon, the inriver goal; and 190,000 for chum salmon, the lower bound escapement goal.

## ENVIRONMENTAL DATA

Weather data was collected at approximately 0800 and 2000 hours each day. The sonar crew measured precipitation to the nearest mm using a Taylor Clear View rain gauge, air temperatures to the nearest 0.1 C using an Oregon Scientific digital thermometer, and wind direction and velocity (km/h) using a Weathertronics anemometer.

## RESULTS

### HYDROACOUSTIC COUNTING

Hydroacoustic counting began on the right bank on 4 June and the next day on the left bank and ended on both banks 19 July. A total of 739,985 individual salmon-sized acoustic targets were recorded in 2007 (Table 1). Sonar count distribution by bank varied throughout the season with counts at the end of the season totaling 106,711 (14.4%) on the left bank and 633,274 (85.6%) on

the right bank. The 2 inshore strata accounted for 80.8% of the total sonar count. The inshore strata accounted for 68.2% of the left bank count and 82.9% of the right bank count (Table 1; Appendices A1 through A4).

### **Spatial and Temporal Distribution of Sonar Counts**

Peak daily passage in both the left bank inshore and offshore strata occurred on 23 June (Table 1; Appendix A1 and A2). Peak daily passage counts on the right bank inshore and offshore strata also occurred on 23 June (Table 1; Appendix A3 and A4).

Hourly fish passage from 4 June to 19 July varied within and among strata. Peak counts on the left bank occurred at 2200 inshore and at 0200 offshore, and counts were lowest at 0400 inshore and offshore (Figure 2). Peak counts on the right bank occurred at 2200 inshore and 1500 offshore, and counts were lowest at 1100 inshore and 0400 offshore (Figure 3).

### **Escapement Sampling**

In 2007, a total of 2,712 gillnet drifts were completed. The duration of each gillnet drift was approximately 2.5 minutes. The 13.0 cm, 15.2 cm, and 20.6 cm mesh gillnets caught 920, 819, and 239 salmon (Table 2). The total gillnet catch of 1,978 fish was composed of 1,009 sockeye salmon, 443 Chinook salmon, and 526 chum salmon. Most salmon were caught in the right bank offshore stratum (714) followed by the right inshore (629), left offshore (384), and left inshore (251) strata (Table 2).

The 13.0 cm gillnet caught the greatest number of sockeye salmon (489), followed by the 15.2 cm (395), and 20.6 cm (125) mesh gillnets. Chinook salmon were captured predominantly in the 13.0 cm mesh gillnet (187), followed by the 15.2 cm mesh gillnet (167), and 20.6 cm mesh gillnet (89). Chum salmon were caught predominantly in both the 13.0 cm mesh gillnet (244) and 15.2 cm mesh gillnet (257), followed by the 20.6 cm mesh gillnet (25) (Table 2). Sockeye, Chinook, and chum salmon dominated catches throughout June and July (Tables 3, 4, 5, and 6).

### **Estimates of Escapement**

The overall salmon escapement estimate for Nushagak River in 2007 was 739,985 fish ( $SE = 17,717$ ). This included an estimated 518,041 sockeye ( $SE = 13,537$ ; 90% CI of  $\pm 22,200$ ), 60,459 Chinook ( $SE = 3,679$ ; 90% CI of  $\pm 6,034$ ), and 161,483 chum ( $SE = 10,822$ ; 90% CI of  $\pm 17,748$ ) salmon (Tables 7 and 8).

#### ***Sockeye Salmon***

Sockeye salmon were first counted on 12 June, and accounted for 4.1% of the salmon passage on that day. On 19 July, at project's end, sockeye salmon accounted for 60.3% of the daily salmon passage. Daily passage ranged from 16 fish on 14 June to a peak of 51,189 on 23 June (Tables 7 and 9; Figure 4).

Most sockeye salmon, 455,560 fish (87.9%), passed the right bank, while 62,482 (12.1%) passed the left bank. On both banks, the majority passed through the inshore strata (91.1% on the left bank and 92.5% on the right bank). Peak passage occurred on both banks in the inshore strata on 23 June: 9,975 in the left bank inshore stratum and 38,162 in the right bank inshore stratum (Table 10). The point at which the cumulative escapement reached 50% of the final escapement was 2 days later than the average throughout the 2000s and 2 days earlier than the 1990s (Figure 4).

### ***Chinook Salmon***

Chinook salmon accounted for 81.3% of the salmon passage when counting began on 4 June and 11.7% on 19 July when counting stopped. Daily passage ranged from a low of 5 fish on 4 June to a peak of 8,943 on 23 June (Tables 7, 10, and 11; Figure 5).

Chinook passage occurred primarily on the right bank with 41,700 (69.0%) fish while 18,758 (31.0%) passed the left bank. On both banks, most Chinook passed through the offshore strata (15,243 fish or 81.3% on the left bank and 30,891 fish or 74.1% on the right bank). Peak passage occurred on both banks on 23 June with a passage of 3,826 fish in the left bank offshore strata and a passage of 5,117 in the right bank offshore strata (Table 10). The point at which the cumulative escapement reached 50% of the final escapement was 4 days later than the average throughout the 2000s and 2 days later than the 1990s (Figure 5).

### ***Chum Salmon***

Chum salmon accounted for 18.8% of the salmon passage when counting began on 4 June and 28.1% of the passage on 19 July when counting stopped. Daily passage ranged from a low of 1 fish on 4 June to a peak of 28,257 on 23 June (Tables 7, 10, and 12; Figure 6).

Chum passage occurred primarily on the right bank with 136,012 (84.2%) fish and 25,468 (15.8%) passing up the left bank. The passage on the left bank was fairly evenly split between inshore and offshore strata while on the right bank the majority passed through the inshore strata (92,679 fish or 68.1%). Peak passage occurred in the offshore left bank and inshore right bank strata on 23 June with passages of 2,995 and 13,877 respectively (Table 10). The point at which the cumulative escapement reached 50% of the final escapement was 1 day later than the average throughout the 2000s and 4 days earlier than the 1990s (Figure 6).

### **Age, Sex, and Size Estimates**

We estimated sockeye salmon ASL composition for 2 time strata based on 1,078 readable scales (Table 13). The dominant age classes between 4 June and 1 July (Period 1), were age-1.3 (72.8%; 2002 brood year), age-1.2 (17.9%; 2003 brood year), and age-1.4 (6.9%; 2001 brood year). The sex composition during this time was 48.0% males and 52.0% females (Table 14). Mean length by age ranged from 466 mm for age 2.2 to 608 mm for age-2.3. The dominant age class between 1 July and 19 July (Period 2), was age-1.3 (61.3%), followed by age-1.2 (21.7%), and age-1.4 (11.8%). The sex composition during this time was 56.6% males and 43.2% females. Mean length by age ranged from 420 mm for age-0.2 to 610 mm for age-2.3. The overall sex composition sampled was 52.6% males and 47.3% females. Mean length by age ranged from 420 mm for age-0.2 to 610 mm for age-2.3 fish.

Chinook salmon ASL composition were estimated based on 431 readable scales (Table 15). Three major age classes were present: age-1.2 (46.6%; 2003 brood year), age-1.3 (28.3%; 2002 brood year), and age-1.4 (22.5%; 2001 brood year). The sex composition was 66.7% males and 33.3% females. Mean length by age ranged from 344 mm for age-1.1 to 855 mm for age-1.5 (Table 16).

We estimated chum salmon ASL composition based on 405 readable scales (Table 17). The dominant age class was age-0.4 (58.8%; 2001 brood year), followed by age-0.3 (39.0%; 2003 brood year). The sex composition was 58.9% males and 41.1% females. Mean length by age ranged from 588 mm for age-0.3 to 629 mm for age-0.5 (Table 18).

## **Genetic Sampling**

A total of 404 Chinook and 899 sockeye salmon genetic samples were collected between 15 June and 14 July. The samples were sent to the ADF&G Gene Conservation Lab in Anchorage for later analysis.

## **Environmental Data**

Air temperature was slightly above average throughout the season and water temperature was above average in June and below average during July (Table 19; Appendix B1).

## **DISCUSSION**

The purpose of this study was to estimate the escapement of Pacific salmon into the Nushagak River using sonar. The 2007 season was successful in this respect. The primary objective (Objective 1) of this study was achieved for sockeye and Chinook salmon in 2007. The escapement estimate of 518,041 sockeye salmon had a 90% CI of  $\pm 22,200$  fish and was within 4.3% of the escapement estimate. The sockeye salmon escapement estimate fell within the sustainable escapement goal range of 340,000 to 760,000. Cumulative sockeye salmon escapement in 2007 was less than the 1990–2006 average of 542,012 sockeye salmon. The escapement estimate of 60,459 Chinook salmon had a 90% CI of  $\pm 6,034$  fish and was within 10.0% of the escapement estimate. The Chinook escapement estimate of 60,459 Chinook salmon was below the inriver goal of 75,000 fish, but within the sustainable escapement goal range of 40,000 to 80,000 fish. The 2007 escapement estimate of Chinook salmon was the fourth lowest escapement since 1990. The escapement estimate of 161,483 chum salmon had a 90% CI of  $\pm 17,748$  fish and was within 11.0% of the escapement estimate. The chum salmon escapement estimate of 161,482 was below the lower-bound sustainable escapement goal of 190,000 and was the third lowest escapement since 1990.

Sampling efforts were generally adequate to estimate the age composition of sockeye, Chinook and chum salmon in 2007 (Objective 2). The sample size goal of 1,200 sockeye salmon was designed to allow for 3 time strata of 400 samples each, distributed across the early, middle, and late portions of the run. The sonar crew produced 1,089 readable scales during 2007. Therefore, age composition estimates were made for only 2 strata in 2007. Sampling efforts should be increased in the future to adequately sample sockeye salmon to obtain age composition estimates for the early, middle, and late portions of the escapement (Table 13). Age-1.2 and age-1.3 sockeye salmon were the dominant age classes, accounting for 90.7% of the total run.

The sample size goal for Chinook salmon was 500 fish. The crew produced 431 readable scales during 2007. Age composition estimates were made for all the major age classes of Chinook salmon (Table 15). Age-1.3 and -1.2 Chinook salmon were the dominant age classes, accounting for 74.9% of the total run.

The sample size goal for chum salmon was 500 fish. The crew produced 405 readable scales during 2007. Age composition estimates were made for all the major age classes of chum salmon (Table 17). Age-0.3 and -0.4 chum salmon were the dominant age classes, accounting for 97.8% of the total run.

We estimated sex composition (Objective 3) and mean length at age by sex (Objective 4) of sockeye, Chinook, and chum salmon for the 2007 season. The total proportion of males (52.7%) was greater than females (47.3%) for sockeye salmon in 2007 and varied over the season

(Table 14). There were more males than females in Chinook (66.7% males; 33.3% females; Table 16), and chum (58.9% males; 41.1% females; Table 18) salmon. Male sockeye salmon were larger than females (mean length: 558 mm, males; 545 mm, females; Table 14). However, for Chinook salmon, males were smaller than females (mean length: 604 mm, males; 797 mm, females; Table 16). Male chum salmon were larger than females (mean length: 615 mm, males; 572 mm, females; Table 18).

Typically around one-third of Chinook salmon pass one of the right bank strata, while around two-thirds of chum and sockeye salmon do so. In 2007, 87.9% of sockeye, 69.0% of Chinook and 84.2% of chum salmon passed one of the right bank strata.

Historically, around 40% of Chinook pass through inshore strata, while approximately 95% of sockeye and 80% of chum do so as well. In 2007, 23.7% of Chinook salmon passed through inshore strata while 92.3% of sockeye salmon and 65.1% of chum salmon did so as well.

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## **TABLES AND FIGURES**

Table 1.—Daily inshore and offshore sonar counts by bank, Nushagak River sonar project, 2007.

Date	Left Bank <sup>a</sup>			Right Bank		
	Inshore	Offshore	Cumulative	Inshore	Offshore	Cumulative
6/04	0	0	0	6	0	6
6/05	67	30	98	321	30	351
6/06	24	-14	10	133	61	194
6/07	79	79	159	133	49	182
6/08	110	61	171	273	24	298
6/09	43	19	61	375	61	436
6/10	12	-43	-31	593	73	666
6/11	61	134	195	883	414	1,298
6/12	67	24	92	593	189	782
6/13	67	61	128	478	128	606
6/14	61	-6	55	774	85	860
6/15	80	79	159	702	73	775
6/16	147	49	195	405	238	643
6/17	293	303	596	490	950	1,440
6/18	459	1,310	1,768	799	3,527	4,326
6/19	177	445	622	563	2,278	2,841
6/20	122	183	305	684	780	1,463
6/21	165	67	232	871	347	1,219
6/22	1,882	1,273	3,155	5,802	4,843	10,646
6/23	11,638	7,570	19,208	52,040	17,142	69,182
6/24	750	556	1,305	31,204	6,286	37,490
6/25	7,365	1,284	8,649	27,838	3,375	31,213
6/26	8,927	1,417	10,343	35,486	2,674	38,160
6/27	2,799	1,279	4,078	25,833	2,156	27,989
6/28	1,281	1,315	2,596	19,513	7,273	26,786
6/29	1,368	1,606	2,974	25,363	7,426	32,789
6/30	2,587	1,384	3,971	18,366	3,801	22,167
7/01	2,039	958	2,997	15,997	3,710	19,707
7/02	2,049	1,600	3,649	13,390	3,557	16,947
7/03	2,027	1,570	3,597	14,122	3,058	17,180
7/04	1,876	806	2,682	14,926	2,534	17,460
7/05	1,764	631	2,394	22,433	3,222	25,656
7/06	6,881	1,395	8,276	37,502	4,276	41,778
7/07	2,434	1,200	3,634	29,877	4,428	34,305
7/08	1,671	479	2,150	17,975	1,779	19,753
7/09	403	315	718	13,970	2,455	16,425
7/10	1,428	776	2,204	14,297	1,992	16,289
7/11	1,457	564	2,021	10,207	1,797	12,004
7/12	1,189	540	1,729	7,920	1,310	9,230
7/13	2,028	704	2,731	13,414	1,913	15,326
7/14	1,688	539	2,228	9,814	926	10,740
7/15	379	322	701	8,982	926	9,908
7/16	869	376	1,245	8,041	725	8,766
7/17	1,066	327	1,393	9,264	2,284	11,549
7/18	521	218	739	8,537	2,157	10,694
7/19	417	109	526	3,788	962	4,750
Total	72,818	33,893	106,710	524,979	108,295	633,274

<sup>a</sup> The left bank is identified by looking downstream and located to the south of the right bank.

Table 2.—Drift gillnet catch by mesh size and salmon species, Nushagak River sonar project, 2007.

Gillnet Mesh Size	Species	Drift Stratum					
		Left Bank			Right Bank		
Inshore	Offshore	Total	Inshore	Offshore	Total		
13.0 cm	Sockeye	99	31	130	253	106	359
	Chinook	6	79	85	9	93	102
	Chum	28	40	68	53	123	176
	Coho	0	0	0	0	0	0
	Pink	0	0	0	0	0	0
15.2 cm	Sockeye	78	27	105	185	105	290
	Chinook	6	80	86	9	72	81
	Chum	11	82	93	50	114	164
	Coho	0	0	0	0	0	0
	Pink	0	0	0	0	0	0
20.6 cm	Sockeye	21	4	25	68	32	100
	Chinook	1	37	38	1	50	51
	Chum	1	4	5	1	19	20
	Coho	0	0	0	0	0	0
	Pink	0	0	0	0	0	0
All Meshes	Sockeye	198	62	260	506	243	749
	Chinook	13	196	209	19	215	234
	Chum	40	126	166	104	256	360
	Coho	0	0	0	0	0	0
	Pink	0	0	0	0	0	0

Table 3.—Left bank inshore stratum escapement sampling catch proportions by date, drift session, and salmon species, 2007.

Date	Drift Session	Catch	Proportion of Catch				
			Sockeye	Chinook	Chum	Coho	Pink
6/5	1	0	0.00	0.00	0.00	0.00	0.00
6/5	2	0	0.00	0.00	0.00	0.00	0.00
6/5	3	0	0.00	0.00	0.00	0.00	0.00
6/6	1	0	0.00	0.00	0.00	0.00	0.00
6/6	2	0	0.00	0.00	0.00	0.00	0.00
6/6	3	0	0.00	0.00	0.00	0.00	0.00
6/7	1	0	0.00	0.00	0.00	0.00	0.00
6/7	2	0	0.00	0.00	0.00	0.00	0.00
6/7	3	0	0.00	0.00	0.00	0.00	0.00
6/8	1	0	0.00	0.00	0.00	0.00	0.00
6/8	2	0	0.00	0.00	0.00	0.00	0.00
6/8	3	0	0.00	0.00	0.00	0.00	0.00
6/9	1	0	0.00	0.00	0.00	0.00	0.00
6/9	2	0	0.00	0.00	0.00	0.00	0.00
6/9	3	0	0.00	0.00	0.00	0.00	0.00
6/10	1	0	0.00	0.00	0.00	0.00	0.00
6/10	2	0	0.00	0.00	0.00	0.00	0.00
6/10	3	0	0.00	0.00	0.00	0.00	0.00
6/11	1	0	0.00	0.00	0.00	0.00	0.00
6/11	2	0	0.00	0.00	0.00	0.00	0.00
6/11	3	0	0.00	0.00	0.00	0.00	0.00
6/12	1	0	0.00	0.00	0.00	0.00	0.00
6/12	2	0	0.00	0.00	0.00	0.00	0.00
6/12	3	0	0.00	0.00	0.00	0.00	0.00
6/13	1	0	0.00	0.00	0.00	0.00	0.00
6/13	2	0	0.00	0.00	0.00	0.00	0.00
6/13	3	0	0.00	0.00	0.00	0.00	0.00
6/14	1	0	0.00	0.00	0.00	0.00	0.00
6/14	2	0	0.00	0.00	0.00	0.00	0.00
6/14	3	0	0.00	0.00	0.00	0.00	0.00
6/15	1	0	0.00	0.00	0.00	0.00	0.00
6/15	2	0	0.00	0.00	0.00	0.00	0.00
6/15	3	0	0.00	0.00	0.00	0.00	0.00
6/16	1	0	0.00	0.00	0.00	0.00	0.00
6/16	2	0	0.00	0.00	0.00	0.00	0.00
6/16	3	0	0.00	0.00	0.00	0.00	0.00
6/17	1	0	0.00	0.00	0.00	0.00	0.00
6/17	2	0	0.00	0.00	0.00	0.00	0.00
6/17	3	0	0.00	0.00	0.00	0.00	0.00
6/18	1	0	0.00	0.00	0.00	0.00	0.00
6/18	2	0	0.00	0.00	0.00	0.00	0.00
6/18	3	0	0.00	0.00	0.00	0.00	0.00
6/19	1	1	0.00	0.00	1.00	0.00	0.00
6/19	2	0	0.00	0.00	0.00	0.00	0.00
6/19	3	0	0.00	0.00	0.00	0.00	0.00

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Table 3.—Page 2 of 3.

Date	Session	Catch	Proportion of Catch				
			Sockeye	Chinook	Chum	Coho	Pink
6/20	1	0	0.00	0.00	0.00	0.00	0.00
6/20	2	0	0.00	0.00	0.00	0.00	0.00
6/20	3	2	1.00	0.00	0.00	0.00	0.00
6/21	1	0	0.00	0.00	0.00	0.00	0.00
6/21	2	0	0.00	0.00	0.00	0.00	0.00
6/21	3	2	1.00	0.00	0.00	0.00	0.00
6/22	1	0	0.00	0.00	0.00	0.00	0.00
6/22	2	0	0.00	0.00	0.00	0.00	0.00
6/22	3	0	0.00	0.00	0.00	0.00	0.00
6/23	1	4	0.75	0.00	0.25	0.00	0.00
6/23	2	3	1.00	0.00	0.00	0.00	0.00
6/23	3	0	0.00	0.00	0.00	0.00	0.00
6/24	1	0	0.00	0.00	0.00	0.00	0.00
6/24	2	0	0.00	0.00	0.00	0.00	0.00
6/24	3	2	0.00	0.50	0.50	0.00	0.00
6/25	1	9	0.89	0.11	0.00	0.00	0.00
6/25	2	15	0.87	0.00	0.13	0.00	0.00
6/25	3	21	1.00	0.00	0.00	0.00	0.00
6/26	1	15	0.93	0.00	0.07	0.00	0.00
6/26	2	23	0.91	0.00	0.09	0.00	0.00
6/26	3	22	0.50	0.14	0.36	0.00	0.00
6/27	1	11	0.55	0.00	0.45	0.00	0.00
6/27	2	3	1.00	0.00	0.00	0.00	0.00
6/27	3	9	1.00	0.00	0.00	0.00	0.00
6/28	1	2	1.00	0.00	0.00	0.00	0.00
6/28	2	1	1.00	0.00	0.00	0.00	0.00
6/28	3	0	0.00	0.00	0.00	0.00	0.00
6/29	1	2	0.00	1.00	0.00	0.00	0.00
6/29	2	4	0.75	0.00	0.25	0.00	0.00
6/29	3	0	0.00	0.00	0.00	0.00	0.00
6/30	1	8	0.63	0.00	0.38	0.00	0.00
6/30	2	2	0.50	0.00	0.50	0.00	0.00
6/30	3	0	0.00	0.00	0.00	0.00	0.00
7/1	1	1	0.00	1.00	0.00	0.00	0.00
7/1	2	7	0.71	0.14	0.14	0.00	0.00
7/1	3	3	1.00	0.00	0.00	0.00	0.00
7/2	1	0	0.00	0.00	0.00	0.00	0.00
7/2	2	1	0.00	1.00	0.00	0.00	0.00
7/2	3	0	0.00	0.00	0.00	0.00	0.00
7/3	1	3	0.67	0.00	0.33	0.00	0.00
7/3	2	0	0.00	0.00	0.00	0.00	0.00
7/3	3	1	1.00	0.00	0.00	0.00	0.00
7/4	1	0	0.00	0.00	0.00	0.00	0.00
7/4	2	1	0.00	1.00	0.00	0.00	0.00
7/4	3	2	1.00	0.00	0.00	0.00	0.00

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Table 3.—Page 3 of 3.

Date	Session	Catch	Proportion of Catch				
			Sockeye	Chinook	Chum	Coho	Pink
7/5	1	1	1.00	0.00	0.00	0.00	0.00
7/5	2	4	0.75	0.00	0.25	0.00	0.00
7/5	3	0	0.00	0.00	0.00	0.00	0.00
7/6	1	6	1.00	0.00	0.00	0.00	0.00
7/6	2	5	0.80	0.00	0.20	0.00	0.00
7/6	3	8	0.88	0.00	0.13	0.00	0.00
7/7	1	4	1.00	0.00	0.00	0.00	0.00
7/7	2	2	0.50	0.50	0.00	0.00	0.00
7/7	3	0	0.00	0.00	0.00	0.00	0.00
7/8	1	7	1.00	0.00	0.00	0.00	0.00
7/8	2	1	1.00	0.00	0.00	0.00	0.00
7/8	3	0	0.00	0.00	0.00	0.00	0.00
7/9	1	0	0.00	0.00	0.00	0.00	0.00
7/9	2	0	0.00	0.00	0.00	0.00	0.00
7/9	3	3	0.33	0.00	0.67	0.00	0.00
7/10	1	0	0.00	0.00	0.00	0.00	0.00
7/10	2	0	0.00	0.00	0.00	0.00	0.00
7/10	3	1	0.00	1.00	0.00	0.00	0.00
7/11	1	0	0.00	0.00	0.00	0.00	0.00
7/11	2	1	1.00	0.00	0.00	0.00	0.00
7/11	3	3	1.00	0.00	0.00	0.00	0.00
7/12	1	0	0.00	0.00	0.00	0.00	0.00
7/12	2	0	0.00	0.00	0.00	0.00	0.00
7/12	3	4	0.50	0.00	0.50	0.00	0.00
7/13	1	4	1.00	0.00	0.00	0.00	0.00
7/13	2	1	0.00	0.00	1.00	0.00	0.00
7/13	3	4	0.50	0.00	0.50	0.00	0.00
7/14	1	4	1.00	0.00	0.00	0.00	0.00
7/14	2	1	1.00	0.00	0.00	0.00	0.00
7/14	3	4	0.50	0.00	0.50	0.00	0.00
7/15	1	2	1.00	0.00	0.00	0.00	0.00
7/15	2	0	0.00	0.00	0.00	0.00	0.00
7/15	3	0	0.00	0.00	0.00	0.00	0.00
7/16	1	0	0.00	0.00	0.00	0.00	0.00
7/16	2	0	0.00	0.00	0.00	0.00	0.00
7/16	3	0	0.00	0.00	0.00	0.00	0.00
7/17	1	1	1.00	0.00	0.00	0.00	0.00
7/17	2	0	0.00	0.00	0.00	0.00	0.00
7/17	3	0	0.00	0.00	0.00	0.00	0.00

Table 4.—Left bank offshore stratum escapement sampling catch proportions by date, drift session, and salmon species, 2007.

Date	Drift Session	Catch	Proportion of Catch				
			Sockeye	Chinook	Chum	Coho	Pink
6/5	1	1	0.00	1.00	0.00	0.00	0.00
6/5	2	0	0.00	0.00	0.00	0.00	0.00
6/5	3	0	0.00	0.00	0.00	0.00	0.00
6/6	1	0	0.00	0.00	0.00	0.00	0.00
6/6	2	0	0.00	0.00	0.00	0.00	0.00
6/6	3	0	0.00	0.00	0.00	0.00	0.00
6/7	1	0	0.00	0.00	0.00	0.00	0.00
6/7	2	0	0.00	0.00	0.00	0.00	0.00
6/7	3	0	0.00	0.00	0.00	0.00	0.00
6/8	1	0	0.00	0.00	0.00	0.00	0.00
6/8	2	0	0.00	0.00	0.00	0.00	0.00
6/8	3	0	0.00	0.00	0.00	0.00	0.00
6/9	1	1	0.00	1.00	0.00	0.00	0.00
6/9	2	0	0.00	0.00	0.00	0.00	0.00
6/9	3	0	0.00	0.00	0.00	0.00	0.00
6/10	1	0	0.00	0.00	0.00	0.00	0.00
6/10	2	0	0.00	0.00	0.00	0.00	0.00
6/10	3	0	0.00	0.00	0.00	0.00	0.00
6/11	1	0	0.00	0.00	0.00	0.00	0.00
6/11	2	0	0.00	0.00	0.00	0.00	0.00
6/11	3	1	0.00	0.00	1.00	0.00	0.00
6/12	1	0	0.00	0.00	0.00	0.00	0.00
6/12	2	0	0.00	0.00	0.00	0.00	0.00
6/12	3	4	0.00	0.00	1.00	0.00	0.00
6/13	1	0	0.00	0.00	0.00	0.00	0.00
6/13	2	0	0.00	0.00	0.00	0.00	0.00
6/13	3	1	0.00	1.00	0.00	0.00	0.00
6/14	1	0	0.00	0.00	0.00	0.00	0.00
6/14	2	0	0.00	0.00	0.00	0.00	0.00
6/14	3	0	0.00	0.00	0.00	0.00	0.00
6/15	1	1	0.00	1.00	0.00	0.00	0.00
6/15	2	0	0.00	0.00	0.00	0.00	0.00
6/15	3	2	0.00	1.00	0.00	0.00	0.00
6/16	1	1	1.00	0.00	0.00	0.00	0.00
6/16	2	0	0.00	0.00	0.00	0.00	0.00
6/16	3	0	0.00	0.00	0.00	0.00	0.00
6/17	1	0	0.00	0.00	0.00	0.00	0.00
6/17	2	0	0.00	0.00	0.00	0.00	0.00
6/17	3	1	0.00	1.00	0.00	0.00	0.00
6/18	1	9	0.11	0.56	0.33	0.00	0.00
6/18	2	9	0.00	0.89	0.11	0.00	0.00
6/18	3	0	0.00	0.00	0.00	0.00	0.00
6/19	1	1	0.00	0.00	1.00	0.00	0.00
6/19	2	4	0.00	0.50	0.50	0.00	0.00
6/19	3	0	0.00	0.00	0.00	0.00	0.00

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Table 4.—Page 2 of 3.

Date	Session	Catch	Proportion of Catch				
			Sockeye	Chinook	Chum	Coho	Pink
6/20	1	0	0.00	0.00	0.00	0.00	0.00
6/20	2	0	0.00	0.00	0.00	0.00	0.00
6/20	3	0	0.00	0.00	0.00	0.00	0.00
6/21	1	0	0.00	0.00	0.00	0.00	0.00
6/21	2	0	0.00	0.00	0.00	0.00	0.00
6/21	3	0	0.00	0.00	0.00	0.00	0.00
6/22	1	0	0.00	0.00	0.00	0.00	0.00
6/22	2	4	0.00	0.75	0.25	0.00	0.00
6/22	3	8	0.00	0.88	0.13	0.00	0.00
6/23	1	20	0.05	0.70	0.25	0.00	0.00
6/23	2	15	0.20	0.33	0.47	0.00	0.00
6/23	3	4	0.00	1.00	0.00	0.00	0.00
6/24	1	2	0.00	1.00	0.00	0.00	0.00
6/24	2	5	0.40	0.40	0.20	0.00	0.00
6/24	3	5	0.60	0.20	0.20	0.00	0.00
6/25	1	11	0.00	0.55	0.45	0.00	0.00
6/25	2	5	0.20	0.40	0.40	0.00	0.00
6/25	3	5	0.40	0.20	0.40	0.00	0.00
6/26	1	4	0.00	0.75	0.25	0.00	0.00
6/26	2	2	0.00	0.50	0.50	0.00	0.00
6/26	3	12	0.58	0.25	0.17	0.00	0.00
6/27	1	9	0.00	1.00	0.00	0.00	0.00
6/27	2	7	0.29	0.29	0.43	0.00	0.00
6/27	3	3	0.33	0.67	0.00	0.00	0.00
6/28	1	4	0.00	1.00	0.00	0.00	0.00
6/28	2	8	0.00	0.63	0.38	0.00	0.00
6/28	3	10	0.00	0.80	0.20	0.00	0.00
6/29	1	6	0.00	0.83	0.17	0.00	0.00
6/29	2	5	0.00	0.80	0.20	0.00	0.00
6/29	3	6	0.00	0.33	0.67	0.00	0.00
6/30	1	13	0.08	0.77	0.15	0.00	0.00
6/30	2	8	0.00	0.38	0.63	0.00	0.00
6/30	3	5	0.60	0.00	0.40	0.00	0.00
7/1	1	13	0.31	0.46	0.23	0.00	0.00
7/1	2	3	0.00	0.67	0.33	0.00	0.00
7/1	3	5	0.20	0.20	0.60	0.00	0.00
7/2	1	4	0.00	0.25	0.75	0.00	0.00
7/2	2	3	0.00	0.67	0.33	0.00	0.00
7/2	3	6	0.00	0.67	0.33	0.00	0.00
7/3	1	3	0.00	0.67	0.33	0.00	0.00
7/3	2	6	0.17	0.17	0.67	0.00	0.00
7/3	3	8	0.00	0.25	0.75	0.00	0.00
7/4	1	5	0.20	0.40	0.40	0.00	0.00
7/4	2	3	0.33	0.67	0.00	0.00	0.00
7/4	3	3	1.00	0.00	0.00	0.00	0.00

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Table 4.—Page 3 of 3.

Date	Session	Catch	Proportion of Catch				
			Sockeye	Chinook	Chum	Coho	Pink
7/5	1	1	1.00	0.00	0.00	0.00	0.00
7/5	2	4	0.25	0.25	0.50	0.00	0.00
7/5	3	1	0.00	0.00	1.00	0.00	0.00
7/6	1	2	0.50	0.50	0.00	0.00	0.00
7/6	2	5	0.40	0.60	0.00	0.00	0.00
7/6	3	1	0.00	1.00	0.00	0.00	0.00
7/7	1	4	0.00	0.25	0.75	0.00	0.00
7/7	2	3	0.33	0.67	0.00	0.00	0.00
7/7	3	0	0.00	0.00	0.00	0.00	0.00
7/8	1	0	0.00	0.00	0.00	0.00	0.00
7/8	2	1	0.00	1.00	0.00	0.00	0.00
7/8	3	4	0.50	0.00	0.50	0.00	0.00
7/9	1	4	0.25	0.25	0.50	0.00	0.00
7/9	2	4	0.25	0.50	0.25	0.00	0.00
7/9	3	0	0.00	0.00	0.00	0.00	0.00
7/10	1	3	0.33	0.33	0.33	0.00	0.00
7/10	2	7	0.57	0.00	0.43	0.00	0.00
7/10	3	4	0.50	0.00	0.50	0.00	0.00
7/11	1	1	0.00	1.00	0.00	0.00	0.00
7/11	2	5	0.00	0.40	0.60	0.00	0.00
7/11	3	2	0.00	0.00	1.00	0.00	0.00
7/12	1	7	0.29	0.29	0.43	0.00	0.00
7/12	2	1	1.00	0.00	0.00	0.00	0.00
7/12	3	5	0.40	0.40	0.20	0.00	0.00
7/13	1	2	0.00	0.50	0.50	0.00	0.00
7/13	2	3	0.00	0.67	0.33	0.00	0.00
7/13	3	5	0.20	0.40	0.40	0.00	0.00
7/14	1	4	1.00	0.00	0.00	0.00	0.00
7/14	2	1	1.00	0.00	0.00	0.00	0.00
7/14	3	4	0.50	0.00	0.50	0.00	0.00
7/15	1	2	1.00	0.00	0.00	0.00	0.00
7/15	2	0	0.00	0.00	0.00	0.00	0.00
7/15	3	0	0.00	0.00	0.00	0.00	0.00
7/16	1	0	0.00	0.00	0.00	0.00	0.00
7/16	2	0	0.00	0.00	0.00	0.00	0.00
7/16	3	0	0.00	0.00	0.00	0.00	0.00
7/17	1	1	1.00	0.00	0.00	0.00	0.00
7/17	2	0	0.00	0.00	0.00	0.00	0.00
7/17	3	0	0.00	0.00	0.00	0.00	0.00

Table 5.—Right bank inshore stratum escapement sampling catch proportions by date, drift session, and salmon species, 2007.

Date	Drift Session	Catch	Proportion of Catch				
			Sockeye	Chinook	Chum	Coho	Pink
6/5	1	0	0.00	0.00	0.00	0.00	0.00
6/5	2	0	0.00	0.00	0.00	0.00	0.00
6/5	3	0	0.00	0.00	0.00	0.00	0.00
6/6	1	0	0.00	0.00	0.00	0.00	0.00
6/6	2	0	0.00	0.00	0.00	0.00	0.00
6/6	3	0	0.00	0.00	0.00	0.00	0.00
6/7	1	0	0.00	0.00	0.00	0.00	0.00
6/7	2	0	0.00	0.00	0.00	0.00	0.00
6/7	3	0	0.00	0.00	0.00	0.00	0.00
6/8	1	0	0.00	0.00	0.00	0.00	0.00
6/8	2	0	0.00	0.00	0.00	0.00	0.00
6/8	3	0	0.00	0.00	0.00	0.00	0.00
6/9	1	0	0.00	0.00	0.00	0.00	0.00
6/9	2	0	0.00	0.00	0.00	0.00	0.00
6/9	3	0	0.00	0.00	0.00	0.00	0.00
6/10	1	0	0.00	0.00	0.00	0.00	0.00
6/10	2	0	0.00	0.00	0.00	0.00	0.00
6/10	3	0	0.00	0.00	0.00	0.00	0.00
6/11	1	1	0.00	1.00	0.00	0.00	0.00
6/11	2	0	0.00	0.00	0.00	0.00	0.00
6/11	3	1	0.00	0.00	1.00	0.00	0.00
6/12	1	0	0.00	0.00	0.00	0.00	0.00
6/12	2	0	0.00	0.00	0.00	0.00	0.00
6/12	3	1	0.00	1.00	0.00	0.00	0.00
6/13	1	0	0.00	0.00	0.00	0.00	0.00
6/13	2	0	0.00	0.00	0.00	0.00	0.00
6/13	3	0	0.00	0.00	0.00	0.00	0.00
6/14	1	0	0.00	0.00	0.00	0.00	0.00
6/14	2	0	0.00	0.00	0.00	0.00	0.00
6/14	3	0	0.00	0.00	0.00	0.00	0.00
6/15	1	0	0.00	0.00	0.00	0.00	0.00
6/15	2	0	0.00	0.00	0.00	0.00	0.00
6/15	3	0	0.00	0.00	0.00	0.00	0.00
6/16	1	0	0.00	0.00	0.00	0.00	0.00
6/16	2	0	0.00	0.00	0.00	0.00	0.00
6/16	3	0	0.00	0.00	0.00	0.00	0.00
6/17	1	0	0.00	0.00	0.00	0.00	0.00
6/17	2	0	0.00	0.00	0.00	0.00	0.00
6/17	3	0	0.00	0.00	0.00	0.00	0.00
6/18	1	8	0.13	0.25	0.63	0.00	0.00
6/18	2	2	0.00	0.00	1.00	0.00	0.00
6/18	3	4	0.00	0.50	0.50	0.00	0.00
6/19	1	0	0.00	0.00	0.00	0.00	0.00
6/19	2	0	0.00	0.00	0.00	0.00	0.00
6/19	3	2	0.00	0.50	0.50	0.00	0.00

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Table 5.—Page 2 of 3.

Date	Session	Catch	Proportion of Catch				
			Sockeye	Chinook	Chum	Coho	Pink
6/20	1	0	0.00	0.00	0.00	0.00	0.00
6/20	2	2	1.00	0.00	0.00	0.00	0.00
6/20	3	0	0.00	0.00	0.00	0.00	0.00
6/21	1	4	1.00	0.00	0.00	0.00	0.00
6/21	2	0	0.00	0.00	0.00	0.00	0.00
6/21	3	5	1.00	0.00	0.00	0.00	0.00
6/22	1	0	0.00	0.00	0.00	0.00	0.00
6/22	2	1	1.00	0.00	0.00	0.00	0.00
6/22	3	3	0.00	0.00	1.00	0.00	0.00
6/23	1	4	0.75	0.00	0.25	0.00	0.00
6/23	2	4	0.50	0.00	0.50	0.00	0.00
6/23	3	7	0.86	0.00	0.14	0.00	0.00
6/24	1	8	0.75	0.13	0.13	0.00	0.00
6/24	2	18	0.56	0.00	0.44	0.00	0.00
6/24	3	17	0.65	0.00	0.35	0.00	0.00
6/25	1	20	0.85	0.00	0.15	0.00	0.00
6/25	2	34	0.76	0.00	0.24	0.00	0.00
6/25	3	35	0.89	0.00	0.11	0.00	0.00
6/26	1	35	0.63	0.03	0.34	0.00	0.00
6/26	2	35	0.83	0.03	0.14	0.00	0.00
6/26	3	28	0.68	0.07	0.25	0.00	0.00
6/27	1	4	1.00	0.00	0.00	0.00	0.00
6/27	2	14	0.86	0.00	0.14	0.00	0.00
6/27	3	6	0.83	0.00	0.17	0.00	0.00
6/28	1	5	0.60	0.00	0.40	0.00	0.00
6/28	2	2	1.00	0.00	0.00	0.00	0.00
6/28	3	6	0.67	0.17	0.17	0.00	0.00
6/29	1	6	0.67	0.00	0.33	0.00	0.00
6/29	2	4	1.00	0.00	0.00	0.00	0.00
6/29	3	2	0.50	0.00	0.50	0.00	0.00
6/30	1	4	0.50	0.25	0.25	0.00	0.00
6/30	2	5	0.80	0.00	0.20	0.00	0.00
6/30	3	9	0.89	0.00	0.11	0.00	0.00
7/1	1	8	0.75	0.13	0.13	0.00	0.00
7/1	2	8	0.88	0.00	0.13	0.00	0.00
7/1	3	4	1.00	0.00	0.00	0.00	0.00
7/2	1	5	1.00	0.00	0.00	0.00	0.00
7/2	2	2	1.00	0.00	0.00	0.00	0.00
7/2	3	2	1.00	0.00	0.00	0.00	0.00
7/3	1	2	1.00	0.00	0.00	0.00	0.00
7/3	2	1	1.00	0.00	0.00	0.00	0.00
7/3	3	0	0.00	0.00	0.00	0.00	0.00
7/4	1	0	0.00	0.00	0.00	0.00	0.00
7/4	2	2	1.00	0.00	0.00	0.00	0.00
7/4	3	0	0.00	0.00	0.00	0.00	0.00

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Table 5.—Page 3 of 3.

Date	Session	Catch	Proportion of Catch				
			Sockeye	Chinook	Chum	Coho	Pink
7/5	1	3	1.00	0.00	0.00	0.00	0.00
7/5	2	8	1.00	0.00	0.00	0.00	0.00
7/5	3	1	1.00	0.00	0.00	0.00	0.00
7/6	1	10	1.00	0.00	0.00	0.00	0.00
7/6	2	18	0.89	0.00	0.11	0.00	0.00
7/6	3	23	1.00	0.00	0.00	0.00	0.00
7/7	1	19	1.00	0.00	0.00	0.00	0.00
7/7	2	16	0.88	0.06	0.06	0.00	0.00
7/7	3	9	0.89	0.00	0.11	0.00	0.00
7/8	1	10	0.90	0.00	0.10	0.00	0.00
7/8	2	3	1.00	0.00	0.00	0.00	0.00
7/8	3	2	1.00	0.00	0.00	0.00	0.00
7/9	1	2	1.00	0.00	0.00	0.00	0.00
7/9	2	3	0.67	0.00	0.33	0.00	0.00
7/9	3	3	1.00	0.00	0.00	0.00	0.00
7/10	1	5	1.00	0.00	0.00	0.00	0.00
7/10	2	5	0.60	0.00	0.40	0.00	0.00
7/10	3	2	1.00	0.00	0.00	0.00	0.00
7/11	1	0	0.00	0.00	0.00	0.00	0.00
7/11	2	9	1.00	0.00	0.00	0.00	0.00
7/11	3	4	1.00	0.00	0.00	0.00	0.00
7/12	1	2	0.50	0.00	0.50	0.00	0.00
7/12	2	9	1.00	0.00	0.00	0.00	0.00
7/12	3	14	0.79	0.07	0.14	0.00	0.00
7/13	1	16	0.81	0.06	0.13	0.00	0.00
7/13	2	7	0.86	0.00	0.14	0.00	0.00
7/13	3	8	1.00	0.00	0.00	0.00	0.00
7/14	1	10	0.90	0.10	0.00	0.00	0.00
7/14	2	4	1.00	0.00	0.00	0.00	0.00
7/14	3	10	0.90	0.00	0.10	0.00	0.00
7/15	1	0	0.00	0.00	0.00	0.00	0.00
7/15	2	0	0.00	0.00	0.00	0.00	0.00
7/15	3	4	1.00	0.00	0.00	0.00	0.00
7/16	1	7	0.57	0.00	0.43	0.00	0.00
7/16	2	0	0.00	0.00	0.00	0.00	0.00
7/16	3	1	1.00	0.00	0.00	0.00	0.00
7/17	1	2	1.00	0.00	0.00	0.00	0.00
7/17	2	0	0.00	0.00	0.00	0.00	0.00
7/17	3	0	0.00	0.00	0.00	0.00	0.00

Table 6.—Right bank offshore stratum escapement sampling catch proportions by date, drift session, and salmon species, 2007.

Date	Drift Session	Catch	Proportion of Catch				
			Sockeye	Chinook	Chum	Coho	Pink
6/5	1	0	0.00	0.00	0.00	0.00	0.00
6/5	2	0	0.00	0.00	0.00	0.00	0.00
6/5	3	0	0.00	0.00	0.00	0.00	0.00
6/6	1	0	0.00	0.00	0.00	0.00	0.00
6/6	2	0	0.00	0.00	0.00	0.00	0.00
6/6	3	0	0.00	0.00	0.00	0.00	0.00
6/7	1	3	0.00	1.00	0.00	0.00	0.00
6/7	2	0	0.00	0.00	0.00	0.00	0.00
6/7	3	1	0.00	0.00	1.00	0.00	0.00
6/8	1	0	0.00	0.00	0.00	0.00	0.00
6/8	2	0	0.00	0.00	0.00	0.00	0.00
6/8	3	0	0.00	0.00	0.00	0.00	0.00
6/9	1	0	0.00	0.00	0.00	0.00	0.00
6/9	2	0	0.00	0.00	0.00	0.00	0.00
6/9	3	0	0.00	0.00	0.00	0.00	0.00
6/10	1	0	0.00	0.00	0.00	0.00	0.00
6/10	2	0	0.00	0.00	0.00	0.00	0.00
6/10	3	0	0.00	0.00	0.00	0.00	0.00
6/11	1	2	0.00	1.00	0.00	0.00	0.00
6/11	2	0	0.00	0.00	0.00	0.00	0.00
6/11	3	3	0.00	1.00	0.00	0.00	0.00
6/12	1	0	0.00	0.00	0.00	0.00	0.00
6/12	2	0	0.00	0.00	0.00	0.00	0.00
6/12	3	2	0.50	0.00	0.50	0.00	0.00
6/13	1	0	0.00	0.00	0.00	0.00	0.00
6/13	2	0	0.00	0.00	0.00	0.00	0.00
6/13	3	0	0.00	0.00	0.00	0.00	0.00
6/14	1	0	0.00	0.00	0.00	0.00	0.00
6/14	2	0	0.00	0.00	0.00	0.00	0.00
6/14	3	0	0.00	0.00	0.00	0.00	0.00
6/15	1	0	0.00	0.00	0.00	0.00	0.00
6/15	2	0	0.00	0.00	0.00	0.00	0.00
6/15	3	0	0.00	0.00	0.00	0.00	0.00
6/16	1	0	0.00	0.00	0.00	0.00	0.00
6/16	2	0	0.00	0.00	0.00	0.00	0.00
6/16	3	2	0.50	0.00	0.50	0.00	0.00
6/17	1	1	1.00	0.00	0.00	0.00	0.00
6/17	2	0	0.00	0.00	0.00	0.00	0.00
6/17	3	3	0.00	1.00	0.00	0.00	0.00
6/18	1	1	0.00	0.00	1.00	0.00	0.00
6/18	2	1	1.00	0.00	0.00	0.00	0.00
6/18	3	0	0.00	0.00	0.00	0.00	0.00
6/19	1	4	0.25	0.00	0.75	0.00	0.00
6/19	2	2	0.00	0.50	0.50	0.00	0.00
6/19	3	7	0.29	0.00	0.71	0.00	0.00

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Table 6.—Page 2 of 3.

Date	Session	Catch	Proportion of Catch				
			Sockeye	Chinook	Chum	Coho	Pink
6/20	1	0	0.00	0.00	0.00	0.00	0.00
6/20	2	0	0.00	0.00	0.00	0.00	0.00
6/20	3	0	0.00	0.00	0.00	0.00	0.00
6/21	1	0	0.00	0.00	0.00	0.00	0.00
6/21	2	0	0.00	0.00	0.00	0.00	0.00
6/21	3	1	0.00	1.00	0.00	0.00	0.00
6/22	1	2	0.00	0.50	0.50	0.00	0.00
6/22	2	9	0.00	0.67	0.33	0.00	0.00
6/22	3	11	0.09	0.36	0.55	0.00	0.00
6/23	1	21	0.19	0.43	0.38	0.00	0.00
6/23	2	27	0.04	0.37	0.59	0.00	0.00
6/23	3	31	0.16	0.35	0.48	0.00	0.00
6/24	1	18	0.50	0.11	0.39	0.00	0.00
6/24	2	7	0.00	0.86	0.14	0.00	0.00
6/24	3	13	0.08	0.38	0.54	0.00	0.00
6/25	1	4	0.25	0.50	0.25	0.00	0.00
6/25	2	14	0.14	0.21	0.64	0.00	0.00
6/25	3	16	0.19	0.06	0.75	0.00	0.00
6/26	1	3	1.00	0.00	0.00	0.00	0.00
6/26	2	14	0.57	0.07	0.36	0.00	0.00
6/26	3	11	0.36	0.18	0.45	0.00	0.00
6/27	1	10	0.40	0.20	0.40	0.00	0.00
6/27	2	9	0.22	0.22	0.56	0.00	0.00
6/27	3	18	0.56	0.17	0.28	0.00	0.00
6/28	1	2	0.50	0.50	0.00	0.00	0.00
6/28	2	6	0.00	0.50	0.50	0.00	0.00
6/28	3	34	0.06	0.35	0.59	0.00	0.00
6/29	1	12	0.17	0.50	0.33	0.00	0.00
6/29	2	21	0.24	0.48	0.29	0.00	0.00
6/29	3	25	0.32	0.24	0.44	0.00	0.00
6/30	1	7	0.43	0.43	0.14	0.00	0.00
6/30	2	5	0.00	0.80	0.20	0.00	0.00
6/30	3	10	0.40	0.30	0.30	0.00	0.00
7/1	1	7	0.14	0.43	0.43	0.00	0.00
7/1	2	3	0.33	0.00	0.67	0.00	0.00
7/1	3	12	0.42	0.42	0.17	0.00	0.00
7/2	1	4	0.50	0.25	0.25	0.00	0.00
7/2	2	8	0.50	0.13	0.38	0.00	0.00
7/2	3	14	0.14	0.36	0.50	0.00	0.00
7/3	1	7	0.29	0.43	0.29	0.00	0.00
7/3	2	7	0.86	0.14	0.00	0.00	0.00
7/3	3	15	0.40	0.07	0.53	0.00	0.00
7/4	1	4	0.50	0.25	0.25	0.00	0.00
7/4	2	5	0.40	0.40	0.20	0.00	0.00
7/4	3	2	0.50	0.50	0.00	0.00	0.00

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Table 6.—Page 3 of 3.

Date	Session	Catch	Proportion of Catch				
			Sockeye	Chinook	Chum	Coho	Pink
7/5	1	8	0.38	0.50	0.13	0.00	0.00
7/5	2	8	0.50	0.38	0.13	0.00	0.00
7/5	3	14	0.43	0.07	0.50	0.00	0.00
7/6	1	8	0.63	0.13	0.25	0.00	0.00
7/6	2	11	0.18	0.55	0.27	0.00	0.00
7/6	3	8	0.75	0.00	0.25	0.00	0.00
7/7	1	8	0.88	0.13	0.00	0.00	0.00
7/7	2	16	0.56	0.13	0.31	0.00	0.00
7/7	3	8	0.88	0.13	0.00	0.00	0.00
7/8	1	6	0.50	0.00	0.50	0.00	0.00
7/8	2	8	0.88	0.00	0.13	0.00	0.00
7/8	3	5	0.80	0.00	0.20	0.00	0.00
7/9	1	3	0.67	0.00	0.33	0.00	0.00
7/9	2	8	0.63	0.38	0.00	0.00	0.00
7/9	3	3	0.33	0.00	0.67	0.00	0.00
7/10	1	1	0.00	0.00	1.00	0.00	0.00
7/10	2	9	0.78	0.11	0.11	0.00	0.00
7/10	3	20	0.60	0.25	0.15	0.00	0.00
7/11	1	12	0.58	0.25	0.17	0.00	0.00
7/11	2	5	0.60	0.00	0.40	0.00	0.00
7/11	3	9	0.56	0.33	0.11	0.00	0.00
7/12	1	2	0.00	1.00	0.00	0.00	0.00
7/12	2	4	0.25	0.50	0.25	0.00	0.00
7/12	3	6	0.50	0.33	0.17	0.00	0.00
7/13	1	3	0.00	0.67	0.33	0.00	0.00
7/13	2	6	0.50	0.17	0.33	0.00	0.00
7/13	3	5	0.20	0.40	0.40	0.00	0.00
7/14	1	1	0.00	1.00	0.00	0.00	0.00
7/14	2	4	0.00	0.50	0.50	0.00	0.00
7/14	3	4	0.00	0.50	0.50	0.00	0.00
7/15	1	6	0.50	0.17	0.33	0.00	0.00
7/15	2	0	0.00	0.00	0.00	0.00	0.00
7/15	3	1	0.00	1.00	0.00	0.00	0.00
7/16	1	2	0.50	0.50	0.00	0.00	0.00
7/16	2	0	0.00	0.00	0.00	0.00	0.00
7/16	3	4	0.50	0.25	0.25	0.00	0.00
7/17	1	2	0.00	0.50	0.50	0.00	0.00
7/17	2	0	0.00	0.00	0.00	0.00	0.00
7/17	3	5	0.00	1.00	0.00	0.00	0.00

Table 7.-Final daily and cumulative escapement estimates by salmon species, Nushagak River sonar project, 2007.

Date	Sockeye		Chinook		Chum		Total	
	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum
6/4	0	0	5	5	1	1	6	6
6/5	0	0	353	358	96	97	449	455
6/6	0	0	144	502	61	158	204	659
6/7	0	0	273	775	68	226	341	1,000
6/8	0	0	373	1,148	96	322	469	1,469
6/9	0	0	393	1,541	105	427	497	1,966
6/10	0	0	496	2,037	140	567	636	2,602
6/11	0	0	862	2,899	631	1,198	1,493	4,095
6/12	35	35	502	3,401	336	1,534	874	4,969
6/13	24	59	407	3,808	304	1,838	734	5,703
6/14	16	75	530	4,338	369	2,207	915	6,618
6/15	37	112	787	5,125	111	2,318	934	7,552
6/16	132	244	539	5,664	168	2,486	838	8,390
6/17	463	707	1,286	6,950	288	2,774	2,036	10,426
6/18	1,571	2,278	2,713	9,663	1,810	4,584	6,094	16,520
6/19	747	3,025	424	10,087	2,293	6,877	3,464	19,984
6/20	449	3,474	249	10,336	1,070	7,947	1,768	21,752
6/21	1,104	4,578	65	10,401	281	8,228	1,451	23,203
6/22	5,857	10,435	3,154	13,555	4,790	13,018	13,801	37,004
6/23	51,189	61,624	8,943	22,498	28,257	41,275	88,389	125,393
6/24	20,526	82,150	2,422	24,920	15,847	57,122	38,795	164,188
6/25	30,225	112,375	990	25,910	8,646	65,768	39,862	204,050
6/26	33,790	146,165	1,906	27,816	12,807	78,575	48,503	252,553
6/27	25,725	171,890	1,084	28,900	5,258	83,833	32,067	284,620
6/28	14,651	186,541	4,402	33,302	10,329	94,162	29,382	314,002
6/29	21,443	207,984	3,559	36,861	10,761	104,923	35,763	349,765
6/30	15,292	223,276	3,073	39,934	7,773	112,696	26,138	375,903
7/1	16,808	240,084	2,336	42,270	3,559	116,255	22,704	398,607
7/2	16,029	256,113	1,839	44,109	2,728	118,983	20,596	419,203
7/3	17,035	273,148	1,050	45,159	2,692	121,675	20,776	439,979
7/4	18,029	291,177	1,248	46,407	866	122,541	20,143	460,122
7/5	25,391	316,568	780	47,187	1,878	124,419	28,050	488,172
7/6	44,623	361,191	1,569	48,756	3,862	128,281	50,054	538,226

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Table 7.–Page 2 of 2.

Date	Sockeye		Chinook		Chum		Total	
	Daily	Cum	Daily	Cum	Daily	Cum	Daily	Cum
7/7	33,245	394,436	1,720	50,476	2,975	131,256	37,939	576,165
7/8	19,878	414,314	68	50,544	1,957	133,213	21,904	598,069
7/9	14,314	428,628	791	51,335	2,038	135,251	17,143	615,212
7/10	13,916	442,544	422	51,757	4,154	139,405	18,493	633,705
7/11	10,518	453,062	385	52,142	3,122	142,527	14,025	647,730
7/12	8,141	461,203	1,005	53,147	1,812	144,339	10,959	658,689
7/13	13,757	474,960	1,107	54,254	3,194	147,533	18,058	676,747
7/14	10,295	485,255	1,146	55,400	1,526	149,059	12,967	689,714
7/15	9,181	494,436	592	55,992	836	149,895	10,609	700,323
7/16	6,238	500,674	411	56,403	3,361	153,256	10,011	710,334
7/17	7,373	508,047	2,079	58,482	3,489	156,745	12,942	723,276
7/18	6,815	514,862	1,362	59,844	3,256	160,001	11,433	734,709
7/19	3,179	518,041	615	60,459	1,482	161,483	5,276	739,985
Total	518,041		60,459		161,483		739,985	

Table 8.—Total escapement estimates by stratum and species, Nushagak River sonar project, 4 June–19 July, 2007.

Stratum	Left Bank			Right Bank			Total
	Inshore	Offshore	Total	Inshore	Offshore	Total	
Total fish	72,818	33,893	106,710	524,979	108,295	633,274	739,984
Total Var	20,133,332	3,967,125	24,100,457	273,600,961	16,195,837	289,796,798	313,897,255
SE	4,487	1,992	4,909	16,541	4,024	17,023	17,717
CV	0.062	0.059	0.046	0.032	0.037	0.027	0.024
90% CI	7,359	3,266	8,051	27,127	6,600	27,918	29,056
Sockeye salmon	56,912	5,569	62,481	421,487	34,073	455,560	518,041
Total Var	14,373,330	611,722	14,985,052	163,341,083	4,918,931	168,260,014	183,245,066
SE	3,791	782	3,871	12,780	2,218	12,972	13,537
CV	0.067	0.140	0.062	0.030	0.065	0.028	0.026
90% CI	6,218	1,283	6,349	20,960	3,637	21,273	22,200
Chinook salmon	3,516	15,243	18,758	10,810	30,891	41,700	60,459
Total Var	655,416	1,828,930	2,484,346	5,938,003	5,116,361	11,054,364	13,538,710
SE	810	1,352	1,576	2,437	2,262	3,325	3,679
CV	0.230	0.089	0.084	0.225	0.073	0.080	0.061
90% CI	1,328	2,218	2,585	3,996	3,710	5,453	6,034
Chum salmon	12,391	13,079	25,469	92,680	43,334	136,013	161,483
Total Var	5,104,586	1,526,473	6,631,060	104,321,875	6,160,545	110,482,420	117,113,479
SE	2,259	1,236	2,575	10,214	2,482	10,511	10,822
CV	0.182	0.094	0.101	0.110	0.057	0.077	0.067
90% CI	3,705	2,026	4,223	16,751	4,071	17,238	17,748

Table 9.—Sockeye salmon escapement estimates and average escapement percentage by date, Nushagak River, 2000–2007.

Date	Year								Daily Average
	2000	2001	2002	2003	2004	2005	2006	2007	
6/04	—	—	—	—	—	—	—	0	0
6/05	—	—	—	—	—	—	—	0	0
6/06	—	—	—	—	—	—	—	0	0
6/07	—	—	—	65	—	—	—	0	32
6/08	—	—	0	290	0	824	0	0	186
6/09	—	—	0	443	0	175	0	0	103
6/10	73	—	0	376	0	196	199	0	121
6/11	46	—	0	280	0	173	235	0	105
6/12	67	230	0	0	1,186	192	0	35	214
6/13	245	173	221	0	821	449	0	24	242
6/14	86	3,253	0	0	145	365	0	16	483
6/15	54	3,819	0	98	195	1,568	0	37	721
6/16	261	1,031	47	106	402	1,793	200	132	497
6/17	386	247	3	3,541	2,499	1,133	64	463	1,042
6/18	140	194	269	7,598	4,120	20,819	311	1,571	4,378
6/19	453	819	1,530	4,119	9,550	42,794	264	747	7,534
6/20	724	5,772	8,598	3,443	29,527	16,596	153	449	8,158
6/21	405	8,768	6,099	9,853	17,754	44,412	261	1,104	11,082
6/22	264	14,214	6,998	41,818	6,146	25,074	4,226	5,857	13,075
6/23	124	34,970	6,149	78,962	8,452	23,209	9,321	51,189	26,547
6/24	94	29,123	8,488	41,316	36,530	68,594	8,879	20,526	26,694
6/25	1,968	38,804	4,840	52,701	29,831	45,588	41,885	30,225	30,730
6/26	16,742	44,456	4,097	42,533	14,901	19,184	62,776	33,790	29,810
6/27	4,247	28,083	15,018	27,905	12,704	14,404	102,798	25,725	28,861
6/28	45,905	10,449	32,821	34,842	7,114	6,398	42,421	14,651	24,325
6/29	70,221	6,527	20,799	18,552	25,240	10,547	19,830	21,443	24,145
6/30	46,978	22,989	42,265	14,068	37,925	30,292	11,320	15,292	27,641

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Table 9.—Page 2 of 3.

Date	Year								Daily Average
	2000	2001	2002	2003	2004	2005	2006	2007	
7/01	30,858	50,353	14,095	19,014	45,691	229,756	19,042	16,808	53,202
7/02	13,997	39,027	16,136	18,946	18,282	159,361	20,561	16,029	37,792
7/03	13,110	85,925	4,484	49,433	9,060	50,767	17,382	17,035	30,900
7/04	15,431	127,463	6,760	42,629	12,969	21,655	16,982	18,029	32,740
7/05	6,656	60,521	5,315	14,427	25,240	12,677	10,898	25,391	20,141
7/06	4,479	32,314	7,548	6,225	23,859	14,083	15,433	44,623	18,570
7/07	2,530	30,063	9,636	3,706	37,439	26,381	13,560	33,245	19,570
7/08	2,535	11,410	10,991	6,045	21,749	42,390	21,961	19,878	17,120
7/09	3,630	15,791	22,223	3,974	5,448	24,660	27,059	14,314	14,637
7/10	5,121	17,238	14,826	2,357	4,788	23,344	13,955	13,916	11,943
7/11	2,581	8,273	9,110	6,919	3,247	23,364	9,662	10,518	9,209
7/12	5,086	6,604	5,593	3,375	1,273	13,953	9,418	8,141	6,680
7/13	41,229	4,814	4,584	6,364	3,575	7,624	6,440	13,757	11,048
7/14	27,279	6,326	4,029	3,522	8,385	7,214	9,745	10,295	9,599
7/15	4,694	7,171	3,955	3,501	4,643	4,482	12,003	9,181	6,204
7/16	4,880	8,297	3,631	2,505	2,923	2,915	10,362	6,238	5,219
7/17	3,903	5,340	4,255	1,078	3,074	10,213	8,802	7,373	5,505
7/18	3,771	7,388	464	1,214	1,124	—	—	6,815	3,463
7/19	2,562	7,647	658	1,499	729	—	—	3,179	2,712
7/20	2,157	4,081	1,016	891	1,218	—	—	—	1,873
7/21	2,294	3,126	1,383	—	998	—	—	—	1,950
7/22	1,812	6,315	1,097	—	1,183	—	—	—	2,602
7/23	1,986	979	845	—	1,430	—	—	—	1,310
7/24	2,332	784	714	—	1,188	—	—	—	1,254
7/25	1,421	165	1,183	—	0	—	—	—	692
7/26	238	179	334	—	0	—	—	—	188
7/27	291	144	0	—	0	—	—	—	109
7/28	1,202	83	0	—	879	—	—	—	541
7/29	1,027	34	0	—	809	—	—	—	468
7/30	827	51	1,842	—	0	—	—	—	680
7/31	183	201	331	—	78	—	—	—	198

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Table 9.—Page 3 of 3.

Date	Year								Daily Average
	2000	2001	2002	2003	2004	2005	2006	2007	
8/01	1,035	236	278	—	3,036	—	—	—	1,146
8/02	1,071	63	123	—	1,391	—	—	—	662
8/03	1,031	51	0	—	0	—	—	—	271
8/04	769	35	0	—	0	—	—	—	201
8/05	9	34	0	—	32	—	—	—	19
8/06	—	26	0	—	91	—	—	—	39
8/07	—	25	0	—	0	—	—	—	8
8/08	—	29	0	—	856	—	—	—	295
8/09	—	190	0	—	0	—	—	—	63
8/10	—	104	0	—	0	—	—	—	35
8/11	—	94	0	—	0	—	—	—	31
8/12	—	104	0	—	0	—	—	—	35
8/13	—	217	0	—	0	—	—	—	72
8/14	—	135	0	—	0	—	—	—	45
8/15	—	43	0	—	0	—	—	—	14
8/16	—	28	0	—	0	—	—	—	9
8/17	—	16	0	—	—	—	—	—	8
8/18	—	17	—	—	—	—	—	—	17
8/19	—	46	—	—	—	—	—	—	46
8/20	—	16	—	—	—	—	—	—	16
8/21	—	—	—	—	—	—	—	—	—
8/22	—	—	—	—	—	—	—	—	—
8/23	—	—	—	—	—	—	—	—	—
8/24	—	—	—	—	—	—	—	—	—
8/25	—	—	—	—	—	—	—	—	—
8/26	—	—	—	—	—	—	—	—	—
8/27	—	—	—	—	—	—	—	—	—
8/28	—	—	—	—	—	—	—	—	—
8/29	—	—	—	—	—	—	—	—	—
8/30	—	—	—	—	—	—	—	—	—
8/31	—	—	—	—	—	—	—	—	—
9/01	—	—	—	—	—	—	—	—	—
Total	403,500	803,537	315,681	580,534	491,730	1,049,620	548,410	518,041	597,877

Table 10.—Estimated daily passage by species, bank, and stratum, Nushagak River, 2007.

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Date	Sockeye				Chinook				Chum			
	Left Bank		Right Bank		Left Bank		Right Bank		Left Bank		Right Bank	
	Inshore	Offshore	Inshore	Offshore	Inshore	Offshore	Inshore	Offshore	Inshore	Offshore	Inshore	Offshore
6/4	0	0	0	0	0	0	5	0	0	0	1	0
6/5	0	0	0	0	45	30	261	17	22	0	60	14
6/6	0	0	0	0	16	-14	108	34	8	0	25	27
6/7	0	0	0	0	53	79	108	33	26	0	25	16
6/8	0	0	0	0	73	61	222	16	37	0	51	8
6/9	0	0	0	0	29	19	305	41	14	0	70	20
6/10	0	0	0	0	8	-43	482	49	4	0	111	24
6/11	0	0	0	0	41	54	353	414	20	80	530	0
6/12	0	0	0	35	45	0	339	118	22	24	254	35
6/13	0	0	0	24	45	9	273	80	22	52	205	24
6/14	0	0	0	16	41	-1	437	53	20	-5	337	16
6/15	0	0	0	37	53	32	702	0	27	47	0	37
6/16	0	13	0	119	98	35	405	0	49	0	0	119
6/17	0	83	0	380	195	220	490	380	98	0	0	190
6/18	0	96	63	1,412	306	830	168	1,410	153	384	568	706
6/19	0	0	39	707	0	137	131	157	177	308	393	1,415
6/20	82	0	126	242	0	56	140	54	41	126	419	484
6/21	132	0	871	101	0	21	0	45	33	47	0	202
6/22	1,506	0	4,352	0	0	979	0	2,175	376	294	1,451	2,669
6/23	9,975	749	38,162	2,303	0	3,826	0	5,117	1,663	2,995	13,877	9,722
6/24	519	269	17,871	1,867	58	179	567	1,618	173	108	12,765	2,801
6/25	6,833	216	22,499	677	130	420	0	439	402	648	5,339	2,258
6/26	6,872	647	24,867	1,404	297	400	992	217	1,758	370	9,626	1,053
6/27	2,239	262	22,310	914	0	756	0	328	560	262	3,523	914
6/28	1,048	0	13,380	223	0	912	1,115	2,375	233	403	5,018	4,676
6/29	770	0	18,446	2,228	342	883	0	2,334	257	723	6,917	2,864
6/30	1,109	157	12,598	1,428	0	677	1,044	1,353	1,478	550	4,724	1,020
7/1	1,578	266	13,828	1,136	263	319	542	1,211	197	373	1,627	1,363
7/2	1,490	0	13,390	1,149	373	700	0	766	186	900	0	1,642
7/3	1,303	102	14,122	1,508	290	341	0	419	434	1,126	0	1,131
7/4	1,407	526	14,926	1,170	188	280	0	780	281	0	0	585
7/5	1,411	223	22,433	1,324	0	74	0	706	353	334	0	1,192

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Table 10.–Page 2 of 2.

Date	Sockeye				Chinook				Chum			
	Left Bank		Right Bank		Left Bank		Right Bank		Left Bank		Right Bank	
	Inshore	Offshore	Inshore	Offshore	Inshore	Offshore	Inshore	Offshore	Inshore	Offshore	Inshore	Offshore
7/6	6,072	664	35,716	2,172	0	731	0	837	810	0	1,786	1,267
7/7	2,088	0	27,871	3,286	346	478	499	396	0	722	1,507	747
7/8	1,671	205	16,691	1,311	0	68	0	0	0	205	1,284	468
7/9	403	90	12,418	1,403	0	90	0	701	0	135	1,552	351
7/10	1,071	397	11,120	1,328	89	38	0	295	268	341	3,177	369
7/11	1,093	289	7,939	1,198	91	27	0	266	273	247	2,268	333
7/12	892	231	6,692	326	0	124	224	657	297	185	1,004	326
7/13	1,352	85	11,699	621	0	281	311	515	676	338	1,404	776
7/14	1,313	0	8,982	0	0	392	333	421	375	147	499	505
7/15	310	0	8,350	521	0	107	253	231	69	214	380	174
7/16	711	0	5,026	502	0	188	0	223	158	188	3,015	0
7/17	888	0	6,485	0	0	252	0	1,827	178	76	2,779	457
7/18	431	0	5,691	693	0	130	0	1,232	91	88	2,846	231
7/19	344	0	2,525	309	0	65	0	550	72	44	1,263	103
Total	56,912	5,569	421,487	34,073	3,516	15,243	10,810	30,891	12,390	13,078	92,679	43,333

Table 11.—Chinook salmon escapement estimates and average escapement percentage by date, Nushagak River, 2000–2007.

Date	Year								Daily Average
	2000	2001	2002	2003	2004	2005	2006	2007	
6/04	—	—	—	—	—	—	—	5	5
6/05	—	—	—	—	—	—	—	353	353
6/06	—	—	—	—	—	—	—	144	144
6/07	—	—	—	193	—	—	—	273	233
6/08	—	—	1,179	1,032	660	4,712	947	373	1,484
6/09	—	—	7,957	1,773	1,119	1,336	3,873	393	2,742
6/10	309	—	4,774	2,304	1,266	1,712	7,128	496	2,570
6/11	171	—	993	1,205	1,066	981	5,688	862	1,566
6/12	197	561	643	531	3,024	1,379	2,847	502	1,211
6/13	872	559	267	446	4,863	1,381	1,260	407	1,257
6/14	292	7,303	262	366	2,494	1,263	589	530	1,637
6/15	273	9,319	273	1,811	881	3,323	479	787	2,143
6/16	1,107	2,905	626	1,529	957	987	215	539	1,108
6/17	2,791	568	637	2,377	2,543	1,015	479	1,286	1,462
6/18	938	399	221	4,291	3,516	41,155	2,049	2,713	6,910
6/19	1,895	1,230	4,668	2,773	20,395	19,033	1,145	424	6,445
6/20	2,855	1,830	15,187	2,994	10,629	8,609	457	249	5,351
6/21	1,419	3,305	2,773	2,049	3,004	7,465	292	65	2,547
6/22	928	4,247	1,919	2,749	2,127	10,242	3,940	3,154	3,663
6/23	546	6,584	4,762	2,244	5,192	9,188	4,040	8,943	5,187
6/24	428	4,736	3,681	3,671	11,428	5,817	3,527	2,422	4,464
6/25	7,699	4,522	3,247	4,866	2,208	3,766	9,803	990	4,638
6/26	5,441	4,943	1,304	6,053	1,304	3,588	6,285	1,906	3,853
6/27	1,098	3,738	1,385	4,328	2,536	2,143	6,365	1,084	2,835
6/28	2,412	1,772	492	3,170	724	2,249	4,849	4,402	2,509
6/29	2,291	1,113	1,982	2,794	1,734	3,961	3,066	3,559	2,563
6/30	2,451	3,242	1,835	1,758	3,653	4,278	4,595	3,073	3,111

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Table 11.–Page 2 of 3.

Date	Year								Daily Average
	2000	2001	2002	2003	2004	2005	2006	2007	
7/01	3,354	3,784	1,281	1,883	4,584	4,900	8,044	2,336	3,771
7/02	1,560	1,718	2,111	4,029	2,778	4,334	4,921	1,839	2,911
7/03	1,767	2,213	1,549	2,264	1,820	3,461	5,279	1,050	2,425
7/04	2,162	2,883	685	2,293	1,164	2,707	3,668	1,248	2,101
7/05	874	1,225	1,303	1,136	2,824	2,322	3,076	780	1,692
7/06	820	821	2,146	1,060	1,978	2,078	2,654	1,569	1,641
7/07	610	945	1,921	1,082	3,839	2,329	1,569	1,720	1,752
7/08	535	904	2,068	679	1,359	727	3,504	68	1,231
7/09	414	929	784	400	639	166	3,899	791	1,003
7/10	414	1,125	1,398	1,641	240	876	1,702	422	977
7/11	238	651	676	1,009	515	4,782	2,652	385	1,364
7/12	334	525	692	1,270	557	1,214	1,715	1,005	914
7/13	951	367	569	254	312	769	2,198	1,107	816
7/14	1,252	446	940	220	506	1,021	2,130	1,146	957
7/15	391	1,005	688	377	602	241	1,662	592	695
7/16	408	1,309	467	1,375	162	425	1,138	411	712
7/17	291	990	444	479	159	772	953	2,079	771
7/18	297	1,048	785	457	160	–	–	1,362	685
7/19	308	1,015	462	534	243	–	–	615	529
7/20	203	592	391	279	183	–	–	–	330
7/21	181	421	426	–	592	–	–	–	405
7/22	181	743	363	–	412	–	–	–	425
7/23	111	462	220	–	179	–	–	–	243
7/24	87	342	349	–	284	–	–	–	265
7/25	68	162	154	–	57	–	–	–	110
7/26	33	162	355	–	0	–	–	–	138
7/27	55	134	62	–	174	–	–	–	106
7/28	198	85	578	–	26	–	–	–	222
7/29	466	60	300	–	659	–	–	–	371
7/30	72	57	59	–	1,809	–	–	–	499
7/31	136	215	274	–	0	–	–	–	156

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Table 11.–Page 3 of 3.

Date	Year								Daily Average
	2000	2001	2002	2003	2004	2005	2006	2007	
8/01	339	199	34	–	0	–	–	–	143
8/02	370	56	124	–	8	–	–	–	139
8/03	323	57	324	–	8	–	–	–	178
8/04	156	36	290	–	5	–	–	–	122
8/05	0	42	504	–	6	–	–	–	138
8/06	–	39	0	–	0	–	–	–	13
8/07	–	30	13	–	198	–	–	–	81
8/08	–	45	122	–	0	–	–	–	56
8/09	–	260	103	–	14	–	–	–	126
8/10	–	117	60	–	23	–	–	–	67
8/11	–	94	0	–	0	–	–	–	31
8/12	–	435	0	–	0	–	–	–	145
8/13	–	293	0	–	0	–	–	–	98
8/14	–	133	0	–	0	–	–	–	44
8/15	–	52	0	–	0	–	–	–	17
8/16	–	31	0	–	0	–	–	–	10
8/17	–	30	0	–	–	–	–	–	15
8/18	–	29	–	–	–	–	–	–	29
8/19	–	42	–	–	–	–	–	–	42
8/20	–	41	–	–	–	–	–	–	41
8/21	–	–	–	–	–	–	–	–	–
8/22	–	–	–	–	–	–	–	–	–
8/23	–	–	–	–	–	–	–	–	–
8/24	–	–	–	–	–	–	–	–	–
8/25	–	–	–	–	–	–	–	–	–
Total	56,372	92,275	87,141	80,028	116,400	172,708	124,683	60,458	103,742

Table 12.—Chum salmon escapement estimates and average escapement percentage by date, Nushagak River, 2000–2007.

Date	Year								Daily Average
	2000	2001	2002	2003	2004	2005	2006	2007	
6/04	—	—	—	—	—	—	—	1	1
6/05	—	—	—	—	—	—	—	96	96
6/06	—	—	—	—	—	—	—	61	61
6/07	—	—	—	22	—	—	—	68	45
6/08	—	—	3,953	257	0	824	2,204	96	1,222
6/09	—	—	23,653	427	0	87	3,789	105	4,677
6/10	529	—	29,067	375	0	196	12,977	140	6,183
6/11	410	—	9,472	338	0	520	18,762	631	4,305
6/12	552	1,065	4,133	49	1,099	461	11,870	336	2,446
6/13	1,743	928	3,500	19	2,109	57	3,972	304	1,579
6/14	665	14,597	2,297	199	450	729	4,697	369	3,000
6/15	369	17,824	2,199	34	1,011	3,465	3,720	111	3,592
6/16	2,236	5,249	941	19	1,630	168	3,450	168	1,733
6/17	4,290	1,137	757	3,151	10,674	1,617	1,946	288	2,983
6/18	1,117	872	1,749	5,600	5,334	77,821	29,019	1,810	15,415
6/19	3,804	3,290	25,505	5,190	24,978	25,709	14,648	2,293	13,177
6/20	6,188	8,841	39,254	4,222	46,225	9,688	4,165	1,070	14,956
6/21	3,382	14,457	6,047	11,584	16,835	25,570	19,906	281	12,258
6/22	2,326	20,765	4,945	22,038	14,700	30,341	35,805	4,790	16,964
6/23	1,054	36,113	23,275	9,438	15,504	26,537	40,878	28,257	22,632
6/24	889	28,633	27,489	10,139	16,626	22,605	17,186	15,847	17,427
6/25	15,690	29,192	7,190	26,322	6,699	14,381	59,927	8,646	21,006
6/26	14,334	32,744	5,278	2,345	4,997	17,919	44,735	12,807	16,895
6/27	3,637	12,037	31,537	11,819	12,510	13,598	85,437	5,258	21,979
6/28	11,077	4,762	16,033	14,918	6,655	7,052	36,610	10,329	13,429
6/29	17,056	2,991	10,109	7,894	2,109	4,125	18,622	10,761	9,208
6/30	18,172	10,062	11,425	8,495	14,556	18,634	25,451	7,773	14,321

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Table 12.-Page 2 of 3.

Date	Year							Daily Average	
	2000	2001	2002	2003	2004	2005	2006		
7/01	4,925	15,712	20,870	11,916	12,777	19,414	28,610	3,559	14,723
7/02	2,261	7,876	6,360	20,842	4,025	19,906	29,379	2,728	11,672
7/03	2,180	19,047	10,603	13,141	599	7,487	35,158	2,692	11,363
7/04	2,445	28,512	4,164	7,008	3,344	13,101	14,938	866	9,297
7/05	948	26,953	6,631	9,967	2,954	5,754	10,500	1,878	8,198
7/06	693	14,630	3,718	6,898	8,132	7,408	6,779	3,862	6,515
7/07	430	14,176	5,104	18,579	5,374	11,699	2,453	2,975	7,599
7/08	415	12,882	3,715	12,354	4,080	6,005	3,683	1,957	5,636
7/09	524	18,939	2,048	4,379	2,901	4,552	4,511	2,038	4,986
7/10	677	19,411	5,257	6,592	547	14,945	1,106	4,154	6,586
7/11	314	9,898	2,752	5,067	253	17,879	4,636	3,122	5,490
7/12	627	7,687	3,561	4,982	317	9,426	2,836	1,812	3,906
7/13	3,505	5,841	5,112	4,570	512	1,089	2,620	3,194	3,305
7/14	3,875	8,119	9,838	3,045	2,385	474	2,518	1,526	3,973
7/15	687	9,892	4,468	3,309	2,195	1,834	4,741	836	3,495
7/16	705	11,582	3,365	3,142	625	3,675	3,651	3,361	3,763
7/17	626	8,079	5,868	3,834	2,757	9,271	3,110	3,489	4,629
7/18	616	10,033	4,859	2,870	1,956	—	—	3,256	3,932
7/19	449	9,551	1,566	4,392	754	—	—	1,482	3,032
7/20	359	5,057	1,203	3,628	507	—	—	—	2,151
7/21	374	3,850	4,260	—	153	—	—	—	2,159
7/22	283	7,193	2,986	—	153	—	—	—	2,654
7/23	301	4,995	1,566	—	104	—	—	—	1,741
7/24	343	3,779	1,203	—	2,824	—	—	—	2,037
7/25	221	1,181	4,260	—	3,547	—	—	—	2,302
7/26	79	1,242	2,986	—	2,253	—	—	—	1,640
7/27	95	1,008	1,937	—	262	—	—	—	825
7/28	403	597	636	—	1,902	—	—	—	885
7/29	359	245	1,098	—	1,904	—	—	—	901
7/30	269	349	969	—	0	—	—	—	397
7/31	177	1,440	2,546	—	78	—	—	—	1,060

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Table 12.–Page 3 of 3.

Date	Year								Daily Average
	2000	2001	2002	2003	2004	2005	2006	2007	
8/01	336	1,608	1,870	–	740	–	–	–	1,139
8/02	353	442	1,133	–	3,264	–	–	–	1,298
8/03	328	347	1,523	–	78	–	–	–	569
8/04	433	246	15	–	84	–	–	–	195
8/05	89	249	78	–	1,624	–	–	–	510
8/06	16	199	43	–	8	–	–	–	66
8/07	12	201	–	–	2,970	–	–	–	1,061
8/08	9	244	–	–	14	–	–	–	89
8/09	6	1,494	–	–	150	–	–	–	550
8/10	8	858	–	–	0	–	–	–	289
8/11	6	738	–	–	0	–	–	–	248
8/12	7	1,209	–	–	0	–	–	–	405
8/13	12	2,032	–	–	0	–	–	–	681
8/14	8	1,139	–	–	0	–	–	–	382
8/15	5	399	–	–	0	–	–	–	135
8/16	5	253	–	–	0	–	–	–	86
8/17	6	186	–	–	–	–	–	–	96
8/18	–	182	–	–	–	–	–	–	182
8/19	–	388	–	–	–	–	–	–	388
8/20	–	266	–	–	–	–	–	–	266
8/21	–	–	–	–	–	–	–	–	–
8/22	–	–	–	–	–	–	–	–	–
8/23	–	–	–	–	–	–	–	–	–
8/24	–	–	–	–	–	–	–	–	–
8/25	–	–	–	–	–	–	–	–	–
Total	141,324	547,995	429,978	295,413	283,811	456,024	661,002	161,482	391,081

Table 13.—Age composition of sockeye salmon escapement, Nushagak River, 2007.

Sampling Period	Date		Age Group								Total
	Start	End	0.2	0.3	1.2	1.3	2.2	1.4	2.3	2.4	
Period 1:	04 Jun	01 Jul									
	Percent (%)		0.4		17.9		72.8		1.3		6.9
	SE (%)		0.3		1.7		1.9		0.5		1.1
	Number of Fish		915		42,986		174,690		3,201		16,463
	SE (Number)		646		4,021		4,669		1,203		2,651
	Sample Size		2		94		382		7		36
Period 2:	02 Jul	19 Jul									
	Percent (%)		0.4		2.4		21.7		61.3		11.8
	SE (%)		0.3		0.6		1.8		2.1		0.5
	Number of Fish		1,005		6,534		60,316		170,393		32,671
	SE (Number)		710		1,792		4,877		5,762		1,323
	Sample Size		2		13		120		339		65
Total	04 Jun	19 Jul									
	Percent (%)		0.2		1.4		19.9		66.6		9.5
	SE (%)		0.3		0.6		1.7		2.0		0.5
	Number of Fish		1,005		7,449		103,303		345,083		6,720
	SE (Number)		710		1,694		4,540		5,237		1,267
	Sample Size		2		15		214		721		14
											101
											10
											1
											1,078

Table 14.—Sex composition by age and mean length (mm) by age, and sex of sockeye salmon escapement, Nushagak River, 2007.

Sampling Period	Date		Age Group							Total
	Start	End	0.2	0.3	1.2	1.3	2.2	1.4	2.3	
Period 1:	4 Jun	1 Jul								
Males: Percent (%)			50.0	69.1	43.7	42.9	38.9	66.7		48.0
SE (%)				4.8	2.5	20.2	8.2	33.3		6.1
Number of Males			457	29,725	76,370	1,372	6,402	915		115,240
SE (Males)				3,454	4,885	791	1,690	646		4,366
Sample Size (Number)			1	65	167	3	14	2		252
Mean Length			560	482	580	440	610	613		555
SE (Length)				6.5	3.7	29.3	12.4	17.5		3.0
Sample Size (length)			1	65	167	3	14	2		252
Females: Percent (%)			50.0	30.9	56.3	57.1	61.1	33.3	100.0	52.0
SE (%)				4.8	2.5	20.2	8.2			5.7
Number of Females			457	13,262	98,320	1,829	10,061	457	457	124,844
SE (Females)				2,396	5,157	912	2,102			4,683
Sample Size			1	29	215	4	22	1	1	273
Mean Length			550	487	555	486	579	600	580	549
SE (Length)				6.7	1.9	16.0	6.5			1.7
Sample Size			1	29	215	4	22	1	1	273
Both Sexes: Number of Fish			915	42,986	174,690	3,201	16,463	1,372	457	240,084
SE (Number)			646	4,021	4,669	1,203	2,651	791	457	4,389
Sample Size			2	94	382	7	36	3	1	525
Mean Length			555	483	566	466	591	608	580	552
SE (Length)				4.9	1.9	15.5	6.2	11.7		1.7
Sample Size			2	94	382	7	36	3	1	525

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Table 14.–Page 2 of 3.

Sampling Period	Date		Age Group								
	Start	End	0.2	0.3	1.2	1.3	2.2	1.4	2.3	2.4	Total
Period 2:	2 Jul	19 Jul									
Males: Percent (%)			100.0	38.5	58.0	57.5	42.9	49.2	100.0		56.7
SE (%)				14.0	4.5	2.7	20.2	6.2			4.5
Number of Males			1,005	2,513	34,682	98,014	1,508	16,084	3,518		157,325
SE (Males)			710	1,120	3,910	5,653	869	2,762	1,323		4,912
Sample Size			2	5	69	195	3	32	7		313
Mean Length			420	576	454	589	523	613	610		560
SE (Length)			10.0	15.4	5.7	2.5	41.0	6.7	14.1		2.2
Sample Size			2	5	69	195	3	32	7		313
Females: Percent (%)				61.5	42.0	42.5	57.1	50.8			43.3
SE (%)				14.0	4.5	2.7	20.2	6.2			5.2
Number of Females			4,021	25,132	72,379	2,011	16,587				120,130
SE (Females)			1,413	3,393	5,192	1,003	2,802				4,452
Sample Size			8	50	144	4	33				239
Mean Length			560	501	549	499	572				541
SE (Length)			8.9	4.1	2.4	3.1	5.2				1.8
Sample Size			8	50	144	4	33				239
Both Sexes: Number of Fish			1,005	6,534	60,316	170,393	3,518	32,671	3,518		277,957
SE (Number)			710	1,792	4,877	5,762	1,323	3,810	1,323		5,229
Sample Size			2	13	120	339	7	65	7		553
Mean Length			420	566	474	572	509	592	610		552
SE (Length)			10.0	8.0	3.7	1.8	17.6	4.2	14.1		1.5
Sample Size			2	13	119	339	7	65	7		552

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Table 14.–Page 3 of 3.

Sampling Period	Date		Age Group								Total
	Start	End	0.2	0.3	1.2	1.3	2.2	1.4	2.3	2.4	
Total	4 Jun	19 Jul									
Males: Percent (%)			100.0	39.9	62.7	50.5	42.9	45.8	90.6		52.7
SE (%)				23.5	4.7	2.6	20.2	6.9	15.1		5.2
Number of Males			1,005	2,970	64,406	174,383	2,880	22,487	4,433		272,565
SE (Males)			710	1,046	3,706	5,330	833	2,504	1,214		4,689
Sample Size			2	6	134	362	6	46	9		565
Mean Length			420	574	467	585	484	613	611		558
SE (Length)			10.0	12.9	4.3	2.1	25.4	6.0	11.7		1.8
Sample Size			2	6	134	362	6	46	9		565
Females: Percent (%)				60.1	37.3	49.5	57.1	54.2	9.4	100.0	47.3
SE (%)				20.8	4.6	2.6	20.2	7.1			5.5
Number of Females				4,478	38,394	170,700	3,840	26,648	457	457	244,973
SE (Females)				1,347	3,085	5,172	960	2,560			4,571
Sample Size				9	79	359	8	55	1	1	512
Mean Length				559	496	552	493	574	600	580	545
SE (Length)				7.9	3.6	1.5	8.0	4.1			1.3
Sample Size				9	79	359	8	55	1	1	512
Both Sexes: Number of Fish			1,005	7,449	103,303	345,083	6,720	49,134	4,890	457	518,041
SE (Number)			710	1,694	4,540	5,237	1,267	3,465	1,197	457	4,858
Sample Size			2	15	214	721	14	101	10	1	1,078
Mean Length			420	565	478	569	489	592	610	580	552
SE (Length)			10.0	7.0	3.0	1.3	11.8	3.5	10.6		1.1
Sample Size			2	15	213	721	14	101	10	1	1,077

Table 15.—Age composition of Chinook salmon escapement, Nushagak River, 2007.

Sampling Period	Date		Age Group					Total
	Start	End	1.1	1.2	1.3	1.4	1.5	
Total	04 Jun	19 Jul						
Percent (%)			1.9	46.6	28.3	22.5	0.7	100.0
SE (%)			0.6	2.4	2.2	2.0	0.4	2.2
Number of Fish			1,122	28,195	17,114	13,607	421	60,459
SE (Number)			394	1,454	1,313	1,218	242	1,346
Sample Size			8	201	122	97	3	431

Table 16.—Sex composition by age and mean length (mm) by age, and sex of Chinook salmon escapement, Nushagak River, 2007.

Sampling Period	Date		Age Group					Total
	Start	End	1.1	1.2	1.3	1.4	1.5	
Total:	4 Jun	19 Jul						
Males: Percent (%)			100.0	94.5	52.5	26.0		66.7
SE (%)				1.6	4.5	4.5		2.8
Number of Males			1,122	26,652	8,978	3,507		40,259
SE (Males)			394	1,448	1,037	682		1,293
Sample Size (Number)			8	190	64	25		287
Mean Length			344	558	700	794		604
SE (Length)			7.3	3.9	10.5	23.9		4.1
Sample Size (length)			8	189	64	25		286
Females: Percent (%)				5.5	47.5	74.0	100.0	33.3
SE (%)				1.6	4.5	4.5		4.3
Number of Females				1,543	8,136	9,960	421	20,059
SE (Females)				460	995	1,082	242	1,000
Sample Size				11	58	71	3	143
Mean Length				620	771	843	855	797
SE (Length)				12.9	9.8	7.0	13.2	5.4
Sample Size				11	57	70	3	141
Both Sexes: Number of Fish			1,122	28,195	17,114	13,607	421	60,459
SE (Number)			394	1,454	1,313	1,218	242	1,346
Sample Size			8	201	122	97	3	431
Mean Length			344	561	734	830	855	668
SE (Length)			7.3	3.8	7.2	8.1	13.2	3.3
Sample Size			8	200	121	95	3	427

Table 17.—Age composition of chum salmon escapement, Nushagak River, 2007.

Sampling Period	Date		Age Group			
	Start	End	0.3	0.4	0.5	Total
Total	04 Jun	19 Jul				
Percent (%)			39.0	58.8	2.2	100.0
SE (%)			2.4	2.4	0.7	2.4
Number of Fish			62,998	94,896	3,589	161,483
SE (Number)			3,919	3,955	1,184	3,900
Sample Size			158	238	9	405

Table 18.—Sex composition by age and mean length (mm) by age and sex of chum salmon escapement, Nushagak River, 2007.

Sampling Period	Date		Age Group			
	Start	End	0.3	0.4	0.5	Total
Total:	4 Jun	19 Jul				
Males: Percent (%)			57.3	59.2	77.8	58.9
SE (%)			4.0	3.2	14.7	4.3
Number of Males			35,885	56,220	2,791	94,896
SE (Males)			3,340	3,827	1,047	3,596
Sample Size (Number)			90	141	7	238
Mean Length			600	623	640	615
SE (Length)			3.4	2.6	10.9	2.0
Sample Size (length)			90	141	7	238
Females: Percent (%)			42.7	40.8	22.2	41.1
SE (%)			3.9	3.2	14.7	3.9
Number of Females			26,714	38,676	797	66,188
SE (Females)			2,985	3,429	563	3,236
Sample Size			67	97	2	166
Mean Length			573	571	590	572
SE (Length)			3.8	3.6	10.0	2.6
Sample Size			67	97	2	166
Both Sexes: Number of Fish			62,998	94,896	3,589	161,483
SE (Number)			3,919	3,955	1,184	3,900
Sample Size			158	238	9	405
Mean Length			588	602	629	597
SE (Length)			2.5	2.1	8.7	1.6
Sample Size			157	238	9	404

Table 19.—Average air and water temperature, Nushagak River sonar project, June, July, and August, 1986–2007.

Year	Average Air Temperature (°C)			Average Water Temperature (°C)		
	June	July	August	June	July	August
1986	11.4	12.7	11.0	14.3	12.5	10.0
1987	10.5	14.2	13.1	9.5	12.1	13.1
1988	12.5	14.7	12.6	11.1	14.8	13.7
1989	11.5	14.0	14.8	10.4	14.9	15.6
1990	12.1	13.7	12.3	11.7	14.8	14.1
1991	12.1	14.1	13.1	11.6	14.7	14.3
1992	12.3	12.8	<sup>a</sup>	10.7	11.7	<sup>a</sup>
1993	11.7	14.0	11.9	12.5	15.4	14.3
1994	11.3	11.8	11.7	12.8	12.8	14.6
1995	12.3	13.3	11.0	10.5	14.5	13.0
1996	11.2	12.8	11.5	12.0	14.3	13.2
1997	13.6	15.0	12.5	14.3	16.6	14.6
1998	10.7	12.9	11.4	9.1	13.2	13.2
1999	11.6	14.1	11.3	11.1	13.6	13.1
2000	11.9	12.7	13.0	11.2	13.7	13.3
2001	11.0	10.8	12.1	11.2	13.7	13.3
2002	13.0	13.3	14.6	11.7	14.2	15.8
2003	11.4	13.5	<sup>a</sup>	13.0	14.2	<sup>a</sup>
2004	13.3	15.5	16.7	12.7	15.9	16.3
2005	15.9	15.5	<sup>a</sup>	13.1	15.9	<sup>a</sup>
2006	14.5	18.2	<sup>a</sup>	10.7	14.4	<sup>a</sup>
2007	13.6	14.8	<sup>a</sup>	13.6	13.2	<sup>a</sup>
1986–06 Min	10.5	10.8	11.0	9.1	11.7	10.0
1986–06 Max	15.9	18.2	16.7	14.3	16.6	16.3
1986–06 Average	12.2	13.8	12.6	11.8	14.1	13.8

<sup>a</sup> Project not operated in August.



Figure 1.—Nushagak River sonar site, Bristol Bay.

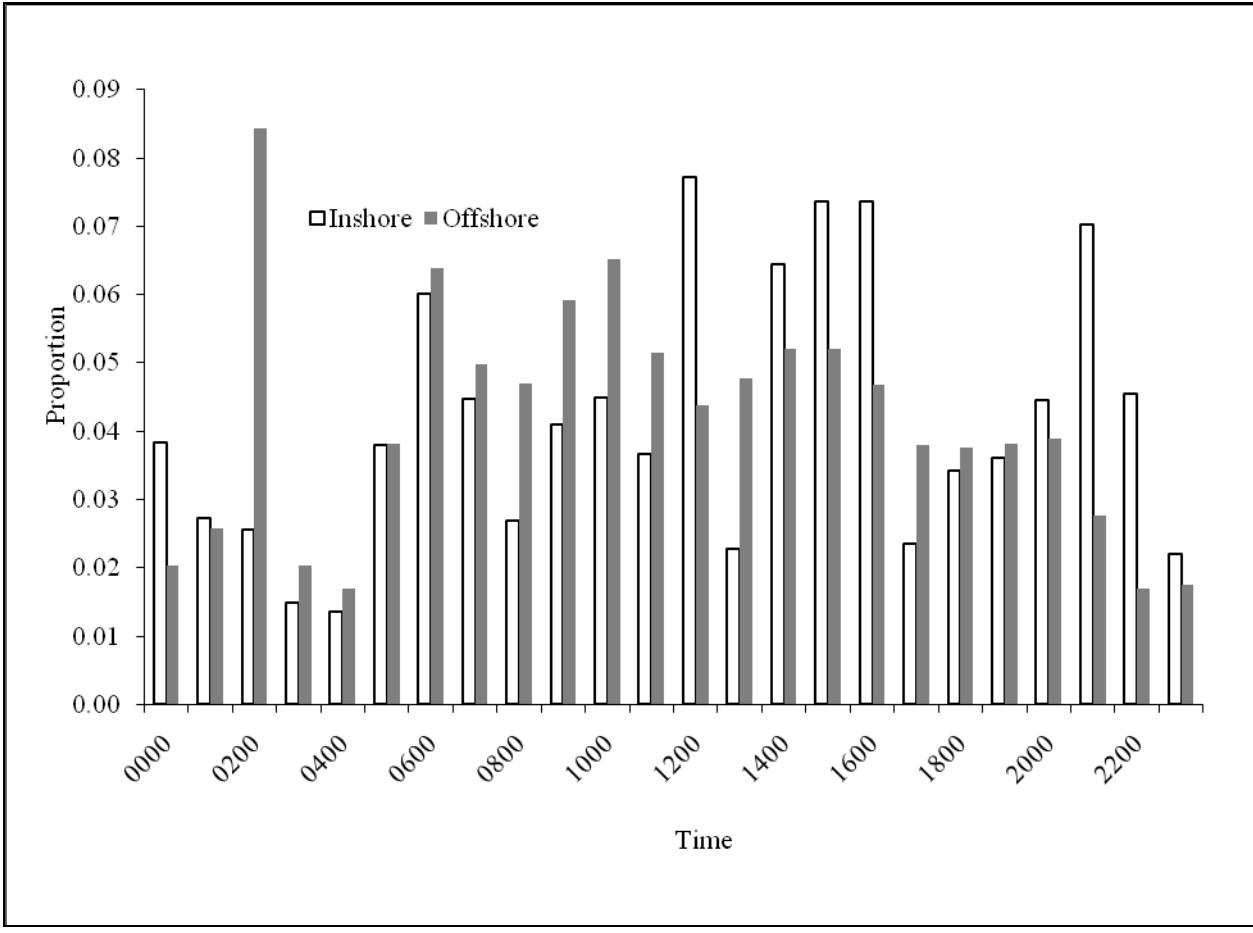


Figure 2.—Average proportion of total sonar counts by hour for the left bank inshore and offshore strata, Nushagak River sonar, 2007.

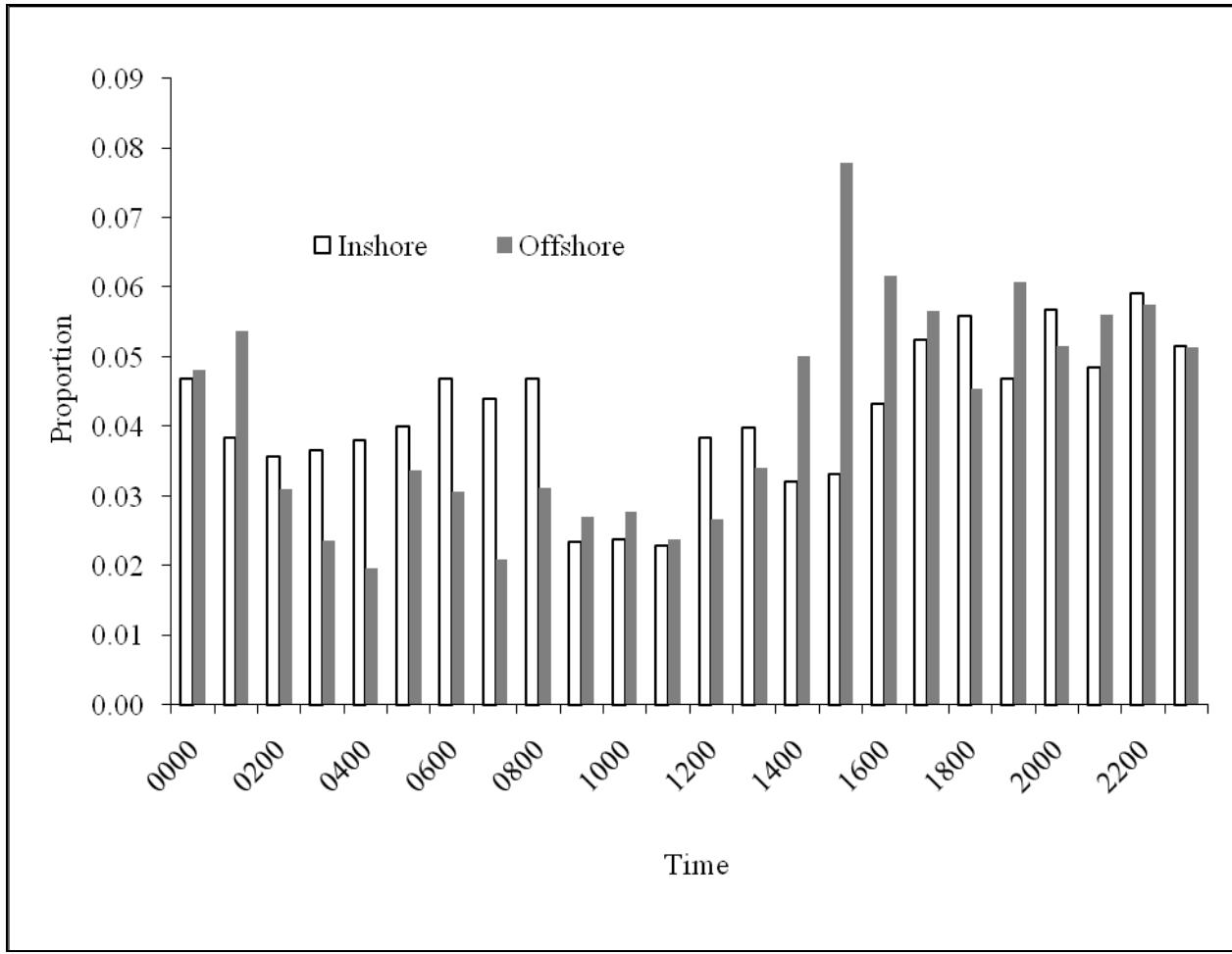


Figure 3.—Average proportion of total sonar counts by hour for the right bank inshore and offshore strata, Nushagak River sonar, 2007.

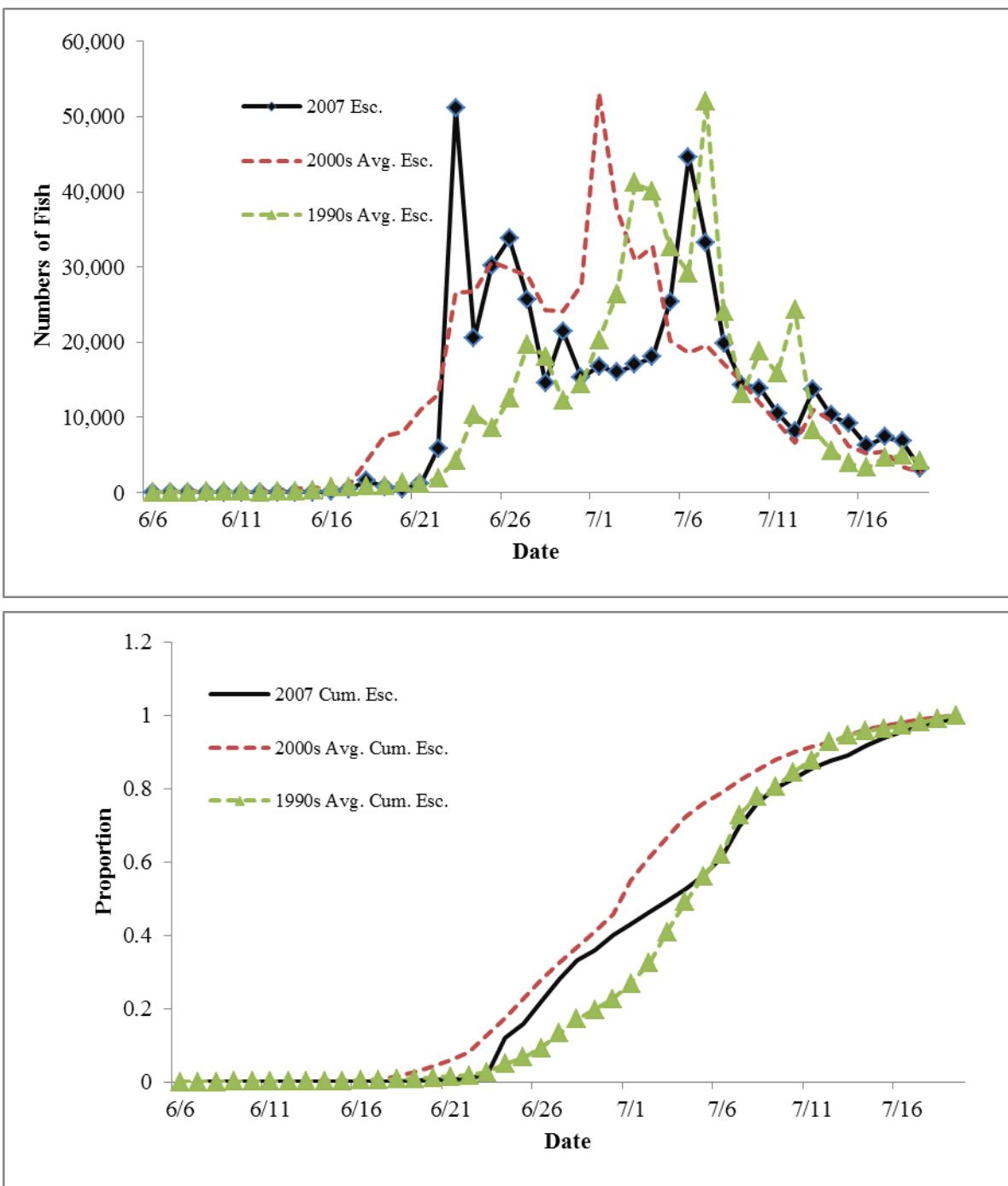


Figure 4.—Average daily (top) and cumulative escapement (bottom) timing for sockeye salmon, Nushagak River sonar, 2007.

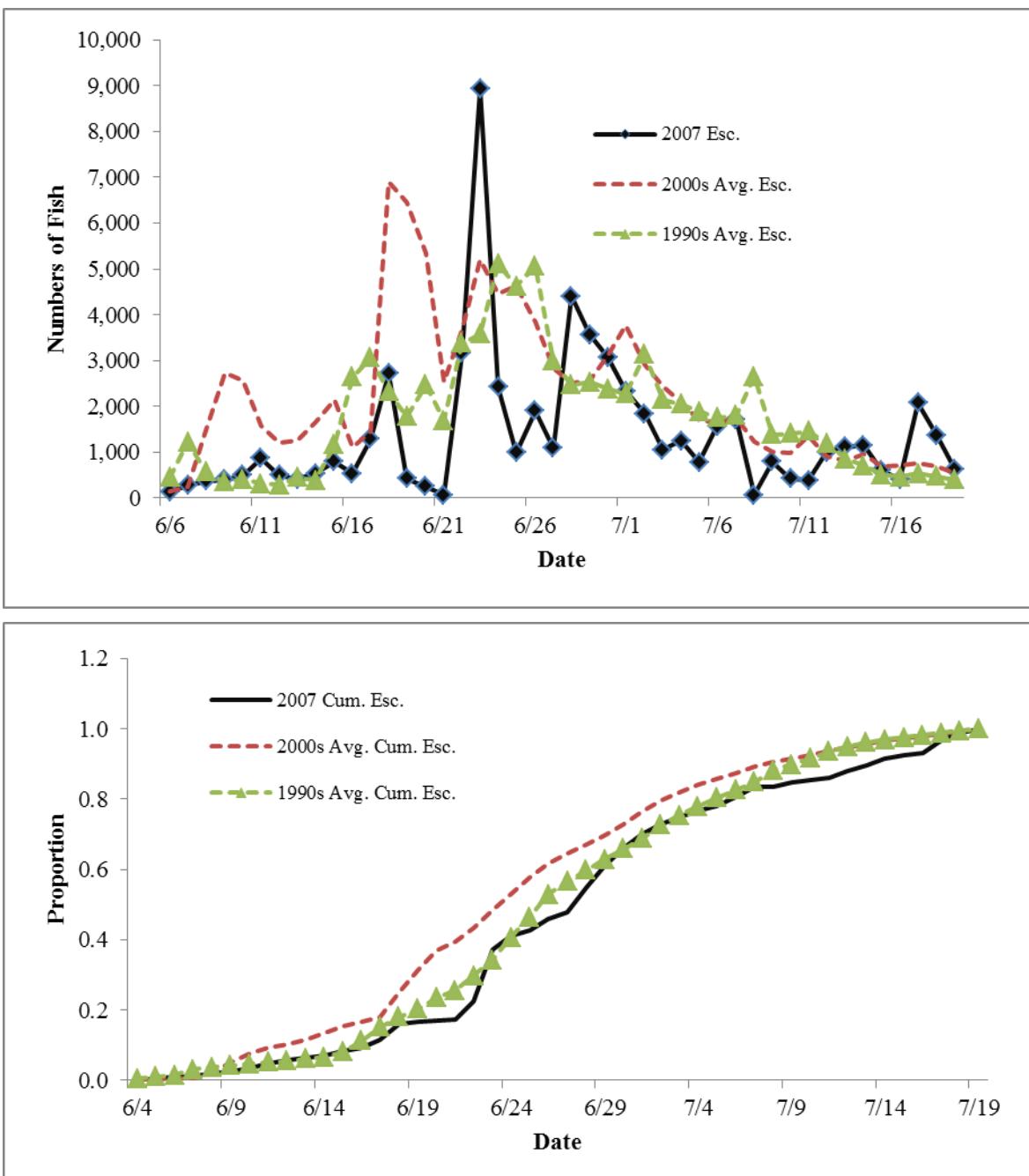


Figure 5.—Average daily (top) and cumulative escapement (bottom) timing for Chinook salmon, Nushagak River sonar, 2007.

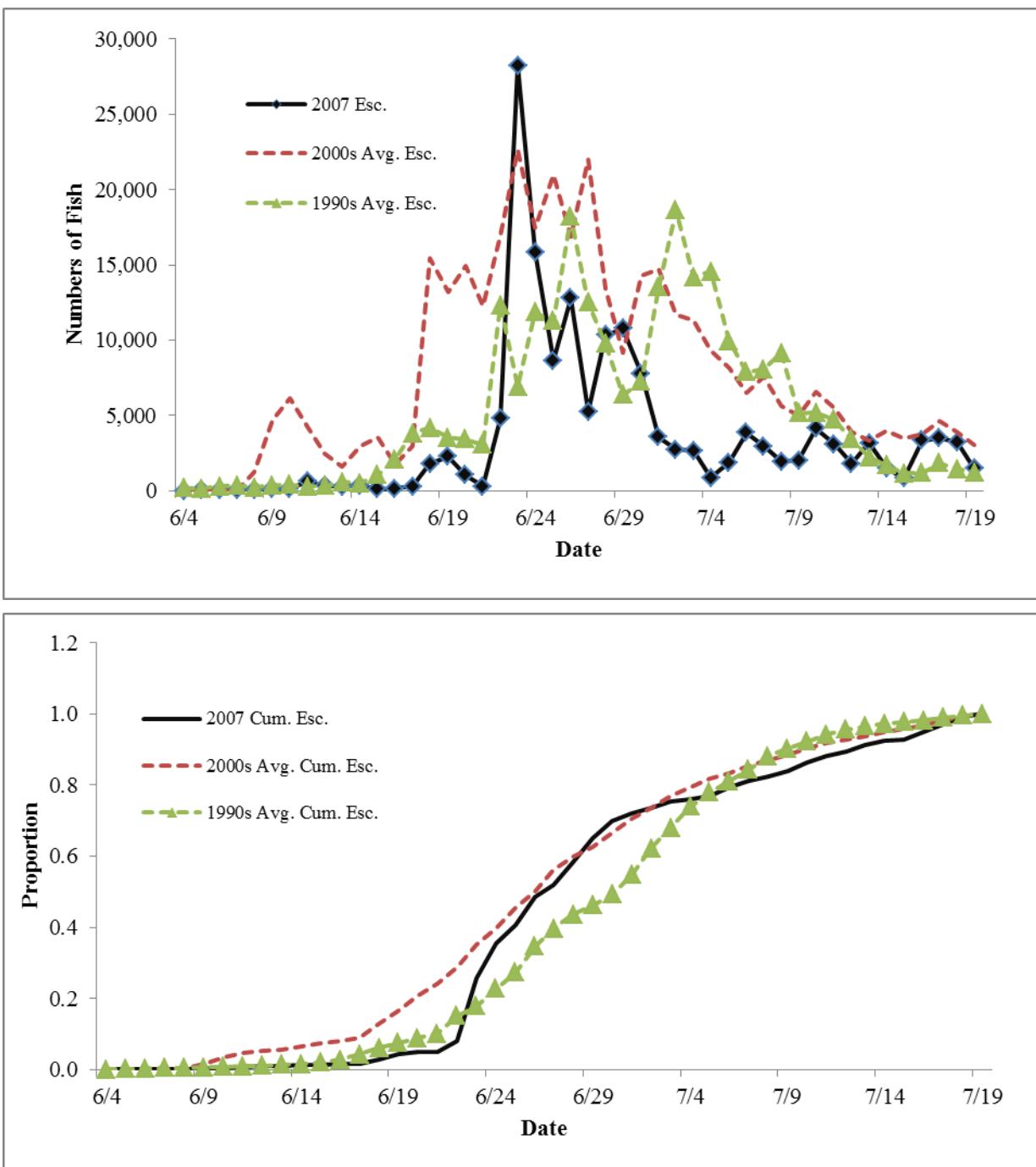


Figure 6.—Average daily (top) and cumulative escapement (bottom) timing for chum salmon, Nushagak River sonar, 2007.

## **APPENDIX A: HOURLY SONAR COUNTS**

Appendix A1.—Sonar hourly counts by date, left bank inshore stratum, Nushagak River sonar project, 2007.

Date	Hour											
	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
6/5	0	6	0	0	6	0	6	6	-6	0	0	6
6/6	12	0	0	-6	0	6	0	6	-6	6	-6	0
6/7	6	0	6	0	6	12	0	0	0	0	18	-6
6/8	6	6	0	0	6	6	6	6	6	0	43	0
6/9	0	6	0	0	0	0	0	6	0	0	0	0
6/10	12	6	0	0	0	-6	0	-6	0	6	-12	6
6/11	0	6	0	0	0	0	-6	-6	6	0	-6	12
6/12	0	0	0	12	0	0	0	25	6	0	18	6
6/13	0	6	12	6	6	12	18	12	-12	0	6	0
6/14	-12	6	0	0	6	0	-12	6	0	24	6	0
6/15	0	0	0	-12	6	6	0	25	12	0	0	-6
6/16	-6	0	12	0	-6	-6	12	0	6	6	12	0
6/17	6	0	0	6	6	-6	18	6	6	37	-12	0
6/18	6	-6	25	37	0	0	6	36	-6	0	31	92
6/19	12	0	61	6	24	-12	24	-18	0	6	6	0
6/20	-12	0	0	0	6	6	18	18	18	6	0	0
6/21	12	12	0	0	0	0	18	12	18	12	0	12
6/22	12	6	0	12	6	6	12	24	18	18	110	49
6/23	1,347	841	448	153	328	1,876	2,337	520	429	104	347	55
6/24	0	37	0	6	18	12	24	30	30	30	18	12
6/25	54	12	147	18	6	6	0	74	49	591	104	91
6/26	18	43	135	178	6	49	24	111	31	763	805	37
6/27	73	74	189	85	214	294	43	220	27	12	85	36
6/28	61	18	12	18	37	12	37	164	55	37	24	91
6/29	6	61	25	6	25	18	92	152	117	61	85	31
6/30	18	43	31	92	25	6	18	202	43	43	43	-6

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Appendix A1.–Page 2 of 4.

Date	Hour											
	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
6/5	18	19	0	12	0	-6	0	0	-6	0	0	6
6/6	0	0	0	0	0	6	0	0	6	0	0	0
6/7	0	0	0	24	0	0	0	0	6	6	0	0
6/8	0	0	0	0	6	0	6	6	6	0	0	0
6/9	0	0	6	12	6	0	0	0	6	0	0	0
6/10	-6	0	0	12	0	12	0	0	0	6	-6	-12
6/11	12	6	6	12	6	0	0	6	0	0	0	6
6/12	0	0	0	0	0	6	0	0	6	0	-12	0
6/13	-12	0	-6	0	0	12	0	0	0	6	0	0
6/14	31	6	0	0	0	-6	0	0	0	0	0	6
6/15	18	12	0	0	18	0	0	0	0	0	0	0
6/16	12	12	30	0	0	31	0	25	0	0	0	6
6/17	6	6	18	37	6	12	0	18	49	43	31	0
6/18	25	127	37	0	12	6	0	12	6	6	6	0
6/19	12	12	0	6	0	0	6	0	12	12	0	6
6/20	18	12	6	-6	6	-6	0	18	6	0	0	6
6/21	12	12	6	0	0	0	-6	0	12	0	18	12
6/22	567	49	-6	103	105	24	31	6	6	165	43	514
6/23	494	250	818	1,139	31	6	6	6	31	12	43	18
6/24	37	12	24	18	6	12	6	0	6	19	377	12
6/25	703	182	281	185	2,107	235	411	380	6	164	1,469	91
6/26	1,255	36	383	1,153	1,343	580	79	31	43	1,361	324	140
6/27	55	55	475	273	31	307	6	134	67	12	12	18
6/28	43	30	49	61	104	43	79	110	12	104	37	43
6/29	55	12	0	0	135	0	43	12	116	128	164	24
6/30	158	0	49	201	147	37	73	183	403	639	110	30

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Appendix A1.–Page 3 of 4.

Date	Hour											
	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
7/1	25	18	49	18	43	25	80	159	98	243	123	6
7/2	237	61	49	12	6	31	153	74	221	24	257	12
7/3	43	67	0	25	37	55	380	92	202	215	166	43
7/4	80	25	43	18	43	43	80	141	18	55	176	80
7/5	135	37	91	178	1	12	6	6	18	6	37	92
7/6	386	98	12	18	-6	6	55	98	55	209	328	1,251
7/7	12	43	31	6	6	12	12	18	49	6	209	98
7/8	43	18	43	37	18	0	515	0	6	12	12	147
7/9	12	12	0	18	0	18	49	12	12	-6	12	43
7/10	18	178	258	49	6	12	12	12	61	12	0	0
7/11	-6	18	37	25	18	12	31	80	42	30	18	6
7/12	6	6	6	0	12	6	12	164	-6	6	18	12
7/13	12	6	18	12	0	123	37	442	172	196	31	31
7/14	12	37	25	12	31	117	43	61	18	55	12	12
7/15	0	0	6	-6	0	6	6	49	31	18	30	36
7/16	6	37	12	6	6	-6	110	25	25	55	12	215
7/17	117	49	31	12	12	0	49	80	49	85	12	49
7/18	18	92	37	12	12	0	6	98	12	-6	18	6
7/19	6	0	12	12	6	0	37	12	31	0	80	18
Total	2,795	2,087	2,062	1,384	1,385	3,271	4,973	3,956	2,762	3,878	4,277	3,775

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Appendix A1.–Page 4 of 4.

Date	Hour											
	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
7/1	158	36	119	18	31	49	207	12	12	294	135	80
7/2	24	6	129	85	104	0	0	6	405	6	25	122
7/3	85	-12	43	12	18	30	0	0	6	276	115	128
7/4	233	140	280	30	0	0	73	37	6	91	172	12
7/5	286	288	43	30	61	25	55	18	18	270	49	0
7/6	62	37	613	448	439	37	546	123	846	1,161	49	12
7/7	405	0	209	313	325	43	12	442	117	31	18	18
7/8	73	0	563	79	6	12	30	25	18	6	6	0
7/9	0	43	25	18	0	12	0	31	-6	12	6	79
7/10	37	129	18	484	18	6	43	12	55	-6	12	0
7/11	12	18	184	147	123	61	268	288	0	18	6	18
7/12	12	37	123	237	6	18	12	55	141	182	12	109
7/13	37	18	110	0	25	31	178	104	383	24	18	18
7/14	18	0	31	91	73	18	231	435	282	61	-12	24
7/15	61	18	6	12	36	12	31	6	6	6	6	0
7/16	117	24	0	67	-6	6	24	43	49	-6	36	12
7/17	343	0	6	12	12	25	0	25	74	6	6	12
7/18	86	25	6	12	18	0	12	12	6	0	18	18
7/19	61	0	6	25	0	12	37	6	30	0	12	12
Total	6,824	2,960	6,089	6,866	6,960	3,410	4,299	4,528	5,249	7,216	5,507	3,904

Appendix A2.—Sonar hourly counts by date, left bank offshore stratum, Nushagak River sonar project, 2007.

Date	Hour											
	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
6/5	0	0	0	0	0	12	0	0	0	6	0	0
6/6	0	0	0	0	0	0	0	-6	-12	0	0	-8
6/7	0	0	0	0	0	6	0	0	0	6	-6	-6
6/8	0	0	6	0	6	6	18	0	12	0	0	0
6/9	0	0	0	0	0	0	0	0	0	0	0	0
6/10	0	6	0	0	6	0	6	0	0	0	0	0
6/11	0	0	6	0	-6	36	24	0	12	6	6	0
6/12	0	6	0	12	0	0	0	6	0	0	0	0
6/13	0	0	0	0	0	12	12	6	6	18	6	0
6/14	0	0	0	0	-6	0	0	0	0	0	0	0
6/15	0	0	6	0	0	6	0	6	0	0	0	0
6/16	0	0	0	0	0	0	0	0	0	0	0	-6
6/17	-6	-6	0	0	0	-24	6	12	0	6	6	0
6/18	24	43	37	55	30	97	110	97	164	91	24	79
6/19	25	12	6	36	36	36	6	0	6	49	18	18
6/20	6	0	6	0	6	6	0	0	0	6	12	43
6/21	0	0	0	0	0	0	0	12	0	12	0	0
6/22	0	0	0	0	0	0	6	0	6	0	0	37
6/23	285	353	2,304	196	159	249	461	363	327	276	634	243
6/24	6	6	6	24	6	24	18	30	6	43	36	18
6/25	43	24	37	12	24	67	61	42	30	98	115	61
6/26	12	24	31	24	24	19	12	43	12	36	85	74
6/27	55	0	0	18	6	91	109	49	55	36	24	60
6/28	12	85	24	30	12	30	54	61	18	24	36	36
6/29	67	12	42	48	6	61	267	109	158	103	67	85
6/30	42	42	24	30	18	48	133	214	18	42	12	85

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Appendix A2.–Page 2 of 4.

Date	Hour											
	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
6/5	0	0	0	0	0	0	0	6	0	0	6	0
6/6	0	0	0	0	0	0	0	0	0	0	12	0
6/7	49	0	24	0	0	0	0	0	0	0	6	0
6/8	0	6	0	0	0	0	0	0	0	0	6	0
6/9	12	0	0	0	0	0	0	0	0	0	0	6
6/10	0	0	0	0	0	0	0	0	0	0	-6	-55
6/11	0	0	18	0	6	0	12	0	0	6	0	6
6/12	0	-6	0	0	0	0	0	6	0	0	0	0
6/13	0	0	0	0	0	0	0	0	0	0	0	0
6/14	0	0	0	0	0	0	0	0	0	0	0	0
6/15	43	0	0	0	0	0	12	0	6	0	0	0
6/16	0	0	12	6	6	6	0	18	6	0	0	0
6/17	0	0	34	0	6	128	67	30	12	18	-6	18
6/18	18	36	86	67	43	30	31	61	37	30	0	18
6/19	18	25	36	24	24	6	6	31	12	0	0	12
6/20	12	42	6	12	0	0	6	0	0	6	12	0
6/21	12	0	0	6	0	-6	6	0	0	0	24	0
6/22	36	36	176	274	221	91	12	18	122	73	79	85
6/23	273	662	328	231	91	12	18	24	-6	61	6	18
6/24	12	18	6	116	19	18	6	37	18	12	37	31
6/25	43	36	224	6	43	74	25	97	18	49	24	30
6/26	61	49	30	85	177	67	270	128	43	24	49	36
6/27	6	49	24	79	97	221	136	24	67	36	36	0
6/28	18	36	24	30	73	158	91	133	127	127	49	24
6/29	55	30	127	170	85	24	0	6	18	36	18	12
6/30	48	0	30	115	139	67	12	12	158	24	42	24

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Appendix A2.–Page 3 of 4.

Date	Hour											
	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
7/1	18	-6	12	12	12	30	48	104	42	55	48	109
7/2	0	18	30	30	30	48	103	79	188	164	91	-12
7/3	6	24	24	18	24	127	182	36	115	91	133	103
7/4	12	24	6	24	42	36	85	55	30	67	103	61
7/5	0	18	30	24	0	18	18	6	18	18	85	12
7/6	12	18	30	24	12	24	24	31	6	48	297	103
7/7	0	36	30	0	12	24	61	12	6	352	91	152
7/8	12	0	0	12	12	0	24	18	0	127	91	0
7/9	0	18	0	0	18	18	-12	12	6	12	67	18
7/10	-12	24	6	12	12	30	30	30	12	55	12	158
7/11	6	6	24	12	0	6	18	18	36	36	18	18
7/12	6	6	12	12	24	12	18	6	61	0	0	24
7/13	6	18	6	6	6	67	145	55	42	18	0	42
7/14	18	30	24	12	30	12	67	67	42	0	30	42
7/15	12	12	6	0	0	12	6	12	48	12	30	24
7/16	12	6	12	0	6	12	12	55	97	12	12	24
7/17	0	12	48	0	12	18	12	18	12	55	24	12
7/18	6	0	18	0	0	12	12	18	6	36	-6	24
7/19	6	0	0	0	-12	0	6	12	6	-12	6	12
Total	692	975	3,056	988	972	1,793	2,766	2,389	2,395	2,905	3,211	2,846

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Appendix A2.–Page 4 of 4.

Date	Hour											
	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
7/1	121	36	18	61	91	6	30	18	30	42	0	18
7/2	42	48	91	42	103	97	145	121	61	6	-6	79
7/3	48	73	12	115	18	12	18	145	115	79	18	30
7/4	18	55	18	12	18	12	30	24	36	30	0	6
7/5	18	48	36	30	73	-12	67	0	73	12	6	30
7/6	109	79	97	48	91	24	79	67	91	55	6	18
7/7	169	61	103	12	36	0	18	6	12	30	-36	12
7/8	12	24	36	-6	0	24	36	18	12	24	0	0
7/9	42	18	0	0	0	-6	24	6	24	18	30	0
7/10	12	12	79	61	48	30	12	55	79	0	12	6
7/11	0	91	97	30	18	6	24	30	18	12	24	12
7/12	18	6	6	48	-12	42	48	73	36	42	0	48
7/13	24	18	-6	36	12	61	12	49	12	12	55	6
7/14	6	0	6	12	0	6	24	18	36	18	6	30
7/15	12	12	0	0	12	42	-6	12	6	6	42	6
7/16	18	6	-12	0	12	0	6	12	24	36	6	6
7/17	18	12	0	12	6	36	0	-6	12	0	0	12
7/18	67	-6	-6	0	18	-12	-6	0	0	12	18	6
7/19	12	6	0	24	12	18	0	12	0	0	0	0
Total	2,687	2,921	3,164	3,262	3,188	2,985	3,074	3,193	3,318	3,041	2,777	2,895

Appendix A3.—Sonar hourly counts by date, right bank inshore stratum, Nushagak River sonar project, 2007.

Date	Hour											
	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
6/4	0	0	0	0	0	0	0	0	0	0	0	0
6/5	6	6	18	0	12	0	18	42	6	6	-6	6
6/6	48	-6	12	0	-6	18	6	0	30	0	0	-6
6/7	0	0	12	12	0	6	0	0	0	0	6	12
6/8	-6	18	24	0	0	18	6	18	12	6	18	6
6/9	12	0	0	-6	6	24	42	12	0	0	30	12
6/10	12	6	0	18	18	18	18	6	0	0	6	54
6/11	97	42	12	0	6	48	12	30	0	79	121	0
6/12	73	48	6	6	6	67	18	18	54	24	6	0
6/13	12	0	30	0	12	24	30	0	6	0	61	12
6/14	-6	12	36	18	0	91	36	97	61	36	24	0
6/15	30	42	30	18	12	30	36	79	12	0	12	54
6/16	12	12	12	36	6	24	0	36	0	-6	-30	6
6/17	42	30	0	61	6	30	12	18	48	54	6	36
6/18	-6	18	30	24	18	54	30	12	48	30	0	54
6/19	6	12	115	12	42	54	18	12	12	12	6	36
6/20	61	85	18	12	18	24	61	6	42	18	0	24
6/21	12	61	-6	12	6	103	73	48	30	61	42	79
6/22	30	36	0	73	67	12	97	42	42	42	12	79
6/23	1,615	1,464	1,960	2,208	2,565	2,414	2,275	1,464	1,531	411	992	1,228
6/24	1,730	1,059	1,416	1,289	871	1,192	1,029	502	1,513	672	212	829
6/25	1,192	1,386	605	714	284	321	877	575	1,307	109	321	611
6/26	1,670	1,827	611	2,245	696	859	2,511	1,089	1,325	248	290	1,271
6/27	1,960	1,470	1,936	1,289	1,827	1,367	1,422	1,139	1,470	1,194	375	290
6/28	363	24	254	363	206	109	647	563	411	296	127	345
6/29	1,434	1,216	829	926	563	1,404	1,912	2,959	914	339	260	315
6/30	1,234	417	357	617	1,035	521	1,388	787	1,210	157	357	502

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Appendix A3.–Page 2 of 4.

Date	Hour											
	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
6/4	0	0	0	0	0	0	0	-6	0	6	6	0
6/5	24	36	0	6	36	36	0	18	12	0	18	18
6/6	0	0	0	-6	12	0	0	6	0	6	6	12
6/7	0	12	0	-6	0	6	12	12	6	0	42	0
6/8	6	36	36	24	0	24	0	0	6	12	6	0
6/9	-6	12	12	0	36	12	6	0	61	24	85	0
6/10	12	182	0	0	12	-12	6	12	24	67	36	97
6/11	206	6	54	12	79	12	36	0	0	18	-6	18
6/12	61	12	30	-42	79	67	18	6	6	12	12	6
6/13	6	97	61	18	0	-6	0	0	0	0	91	24
6/14	42	36	36	0	30	91	6	0	18	6	73	30
6/15	12	-6	79	97	-6	6	67	0	61	6	30	0
6/16	18	6	6	18	6	6	42	12	12	18	115	36
6/17	0	18	0	12	0	6	12	6	30	0	18	42
6/18	61	18	54	18	12	-6	12	24	30	30	224	6
6/19	85	0	18	6	6	0	12	36	18	0	6	36
6/20	0	-6	12	24	0	6	54	73	61	12	42	36
6/21	54	42	54	0	0	0	61	61	0	6	0	73
6/22	145	381	145	218	133	169	18	781	1,156	968	363	793
6/23	1,948	2,959	4,477	805	2,299	4,157	5,288	3,164	1,071	835	2,456	2,450
6/24	823	127	357	1,398	3,340	2,196	3,128	1,073	1,186	1,942	1,119	2,202
6/25	587	405	708	1,265	1,930	2,922	2,408	865	3,618	1,035	1,652	2,142
6/26	1,216	2,717	666	1,041	1,156	2,160	1,240	1,948	2,880	1,978	1,864	1,978
6/27	684	436	514	321	1,392	659	1,228	1,470	1,095	714	1,150	430
6/28	218	284	248	121	375	1,010	1,440	2,553	3,340	2,469	2,977	768
6/29	635	442	653	254	847	805	2,099	684	1,827	1,573	1,888	587
6/30	934	472	611	1,325	678	756	1,178	714	275	500	1,525	817

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Appendix A3.–Page 3 of 4.

Date	Hour											
	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
7/1	557	436	454	363	399	484	762	666	871	363	151	115
7/2	986	430	303	496	315	702	750	417	593	85	333	557
7/3	871	1,192	908	296	436	369	532	623	653	635	417	103
7/4	641	883	557	278	224	466	351	333	442	91	1,440	278
7/5	1,779	696	1,295	895	611	732	526	902	1,251	1,234	1,440	968
7/6	1,107	1,507	1,428	1,660	1,751	1,635	1,580	2,148	2,166	436	563	859
7/7	2,003	1,089	1,531	2,112	3,183	2,148	781	1,912	1,930	835	363	696
7/8	1,156	1,119	883	351	1,464	1,016	980	817	1,549	182	1,010	182
7/9	188	381	466	593	369	696	666	659	508	448	309	115
7/10	309	284	466	363	315	387	829	551	345	575	266	490
7/11	532	351	309	194	296	720	405	678	732	387	230	212
7/12	369	121	321	224	399	520	593	526	327	91	194	79
7/13	442	424	236	327	363	484	1,053	496	750	91	79	212
7/14	345	296	200	315	369	484	484	303	290	478	242	230
7/15	36	436	260	194	284	218	460	711	641	448	889	284
7/16	272	254	127	206	303	393	266	545	466	526	115	345
7/17	702	363	212	133	188	345	405	309	249	793	296	133
7/18	563	375	248	163	242	242	393	605	581	635	666	212
7/19	109	175	145	54	145	151	182	266	182	157	163	97
Total	24,601	20,200	18,866	19,464	20,333	21,528	25,174	23,721	25,413	13,178	13,416	13,122

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Appendix A3.–Page 4 of 4.

Date	Hour											
	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
7/1	641	1,023	430	672	750	684	1,313	696	647	1,501	1,246	774
7/2	823	986	194	267	6	702	151	995	1,159	476	1,025	641
7/3	926	551	284	260	309	405	508	635	587	744	992	883
7/4	902	538	139	290	206	182	448	1,004	980	1,458	1,325	1,470
7/5	1,137	387	460	490	236	605	1,101	387	647	998	1,440	2,214
7/6	1,416	3,509	1,712	2,142	545	2,329	345	1,077	1,095	1,900	2,420	2,172
7/7	1,053	424	774	1,404	1,156	1,246	496	787	974	1,071	944	968
7/8	1,779	1,252	417	375	611	266	309	502	520	207	641	384
7/9	666	290	490	992	551	950	829	762	659	835	956	593
7/10	496	908	1,089	932	1,053	1,083	847	926	230	617	472	466
7/11	502	538	230	309	956	188	545	254	684	327	236	393
7/12	139	218	85	315	532	895	411	417	327	333	200	284
7/13	115	218	405	605	1,434	980	998	290	1,041	1,016	599	756
7/14	405	230	67	133	599	998	260	424	599	424	829	811
7/15	139	200	417	309	67	290	490	339	641	284	538	405
7/16	115	188	224	200	357	236	653	375	678	315	448	436
7/17	430	466	363	248	454	109	575	557	908	54	430	545
7/18	339	151	121	327	121	12	551	496	478	430	333	254
7/19	339	109	103	157	248	296	85	175	97	169	175	6
Total	21,332	22,210	18,238	18,853	24,241	29,242	31,088	26,511	31,744	27,498	33,247	29,360

Appendix A4.—Sonar hourly counts by date, right bank offshore stratum, Nushagak River sonar project, 2007.

Date	Hour											
	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
6/4	0	0	0	0	0	0	0	0	0	0	0	0
6/5	0	0	0	0	0	0	0	0	0	0	0	0
6/6	24	0	12	6	0	0	0	0	0	0	0	0
6/7	0	0	0	0	0	0	0	6	0	18	0	0
6/8	0	0	0	0	0	0	12	0	0	6	6	0
6/9	37	0	0	0	6	6	0	0	0	0	0	0
6/10	-6	0	0	0	6	6	0	0	0	0	0	6
6/11	12	0	12	24	24	-6	24	18	12	18	61	18
6/12	24	0	43	12	18	0	30	0	0	0	0	0
6/13	18	67	6	0	6	18	6	0	6	0	0	0
6/14	0	12	0	0	6	6	0	0	0	0	0	0
6/15	6	6	0	0	0	6	0	0	0	0	6	6
6/16	0	0	0	0	12	6	0	0	55	0	0	0
6/17	6	0	0	0	0	0	0	6	0	0	0	0
6/18	171	207	164	91	140	104	79	110	128	183	140	49
6/19	55	140	189	85	85	24	91	92	49	177	43	30
6/20	55	49	49	12	79	43	12	6	30	61	24	12
6/21	49	18	12	0	18	0	0	37	6	49	0	37
6/22	12	0	6	12	24	18	12	12	0	43	18	12
6/23	1,279	2,266	634	554	402	658	298	280	469	280	250	201
6/24	469	250	219	292	158	238	43	104	177	158	207	55
6/25	73	128	43	43	12	24	43	18	49	73	49	116
6/26	61	317	43	24	37	85	43	12	12	61	30	79
6/27	158	85	30	43	30	37	18	6	79	73	61	55
6/28	12	49	6	30	0	110	91	0	37	30	85	67
6/29	481	256	164	97	79	372	390	214	292	122	244	335
6/30	262	61	91	37	6	98	365	73	207	79	85	79

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Appendix A4.–Page 2 of 4.

Date	Hour											
	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
6/4	0	0	0	0	0	0	0	0	0	0	0	0
6/5	0	12	18	0	0	0	0	0	0	0	0	0
6/6	0	0	0	0	0	0	0	0	0	12	0	6
6/7	0	0	0	0	0	24	0	0	0	0	0	0
6/8	0	0	0	0	0	0	0	0	0	0	0	0
6/9	0	0	0	0	0	0	6	6	0	0	0	0
6/10	0	0	0	0	12	0	0	6	0	24	0	18
6/11	30	24	43	12	0	61	0	6	0	0	0	18
6/12	24	-6	0	43	0	0	0	0	0	0	0	0
6/13	0	0	0	0	0	0	0	0	0	0	0	0
6/14	0	12	0	0	6	0	18	0	0	24	0	0
6/15	0	0	0	0	0	12	-12	6	18	6	18	-6
6/16	0	0	0	0	0	0	12	6	18	43	61	24
6/17	0	24	30	73	49	24	30	146	85	37	171	268
6/18	116	152	152	110	244	225	110	104	213	122	268	146
6/19	24	18	61	164	158	61	146	67	43	177	152	146
6/20	12	18	6	24	37	6	12	12	49	91	61	18
6/21	37	30	6	6	6	-18	6	6	6	6	18	12
6/22	116	225	61	298	378	231	231	487	452	822	487	883
6/23	365	810	566	2,418	1,170	914	585	420	573	475	780	494
6/24	201	268	359	292	225	554	305	408	353	335	274	341
6/25	18	219	335	286	116	91	335	225	146	518	158	256
6/26	85	79	225	213	250	104	146	305	195	110	152	6
6/27	30	49	104	73	335	207	110	146	183	128	55	61
6/28	55	30	85	731	213	1,115	530	1,255	749	871	585	536
6/29	134	305	585	768	256	317	183	256	396	292	761	128
6/30	91	146	104	201	292	177	201	341	298	213	85	207

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Appendix A4.–Page 3 of 4.

Date	Hour											
	0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100
7/1	152	0	37	61	104	79	116	158	140	18	97	67
7/2	134	122	61	55	43	97	146	110	110	128	91	146
7/3	183	146	110	97	30	110	183	43	280	195	134	43
7/4	189	104	55	61	24	110	73	61	122	164	213	128
7/5	104	61	177	43	43	146	152	85	6	43	79	91
7/6	359	256	268	97	122	104	140	128	104	73	189	201
7/7	164	164	183	164	122	116	122	73	37	55	97	183
7/8	61	189	79	61	67	110	24	43	49	79	61	37
7/9	67	67	67	104	24	231	116	30	152	49	128	49
7/10	30	152	128	85	140	110	61	67	55	73	43	79
7/11	134	67	85	116	61	110	104	49	134	0	79	61
7/12	61	55	30	18	30	43	73	55	55	18	49	18
7/13	49	37	43	55	24	97	104	37	73	110	79	49
7/14	43	37	24	43	37	18	97	30	37	18	24	43
7/15	49	24	18	6	18	55	67	30	110	30	18	18
7/16	24	12	24	0	12	55	55	43	18	91	43	24
7/17	18	73	24	12	0	61	37	37	104	122	61	18
7/18	104	274	195	61	55	122	73	55	146	164	152	116
7/19	18	67	12	49	12	18	18	140	37	61	61	37
Total	5,202	5,917	3,544	2,852	2,520	4,143	3,920	2,967	4,175	3,824	4,009	3,664

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Appendix A4.–Page 4 of 4.

Date	Hour											
	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
7/1	43	67	219	238	1,212	189	152	268	91	73	43	85
7/2	164	128	286	262	317	195	213	189	195	116	85	164
7/3	140	128	85	116	91	79	225	110	207	43	140	140
7/4	61	55	37	43	171	85	79	146	97	110	97	250
7/5	134	61	91	104	189	171	189	323	140	219	292	280
7/6	231	116	609	347	104	134	262	128	61	79	85	79
7/7	286	134	548	926	128	110	97	116	37	311	177	79
7/8	49	67	85	61	67	55	73	73	18	61	195	116
7/9	24	97	61	152	164	104	104	116	61	158	189	140
7/10	49	85	55	183	61	30	73	43	43	91	171	85
7/11	0	49	55	67	43	18	110	122	85	110	73	67
7/12	49	55	85	12	37	164	55	116	61	43	79	49
7/13	18	61	262	43	49	128	110	183	61	67	67	110
7/14	67	24	24	30	43	30	61	43	49	30	18	55
7/15	30	24	30	12	12	73	43	24	55	140	30	6
7/16	49	18	24	0	18	18	24	79	43	6	30	12
7/17	30	30	67	85	134	372	55	49	378	49	280	189
7/18	97	18	30	24	30	37	43	134	122	49	30	24
7/19	24	55	24	12	61	18	0	110	0	0	55	73
Total	4,087	4,991	6,821	9,930	8,276	7,816	6,722	8,479	7,580	8,161	8,425	7,868



## **APPENDIX B: CLIMATOLOGICAL OBSERVATIONS**

Appendix B1.—Climatological observations for the Nushagak River, 2007.

Date	Cloud Cover <sup>a</sup>		Precipitation (mm)	Wind Direction & Velocity (k/hr)		Air Temperature (°C)		Water Temperature (°C)		Water Color
	800	2000		800	2000	800	2000	800	2000	
6/06	n	1	0.00	n	NE-15	n	21.0	n	10.0	Light Brown
6/07	2	3	0.15	SE-5	SE-5	8.0	15.0	8.0	8.0	Light Brown
6/08	2	3	0.00	NE-5	CALM	10.0	16.0	9.0	10.0	Light Brown
6/09	4	2	0.11	NE-5	SW-8	11.0	18.0	10.0	11.0	Light Brown
6/10	4	4	Tr	SW-5	W-15	13.0	17.0	10.0	10.0	Light Brown
6/11	4	4	0.23	CALM	SW-20	10.0	14.5	10.0	10.5	Light Brown
6/12	4	4	0.00	S-5	n	8.0	n	9.5	n	Light Brown
6/13	4	4	Tr	CALM	S-10	9.0	13.0	10.0	11.0	Light Brown
6/14	4	4	Tr	CALM	CALM	10.0	24.0	9.8	12.0	Light Brown
6/15	4	2	0.21	CALM	CALM	12.0	14.0	10.0	12.0	Light Brown
6/16	2	4	Tr	CALM	W-20	15.0	11.0	11.5	13.0	Light Brown
6/17	4	3	0.12	CALM	CALM	12.0	16.0	11.5	13.5	Light Brown
6/18	4	3	1.80	CALM	CALM	11.0	16.0	12.0	13.0	Light Brown
6/19	1	1	0.10	CALM	N-5	12.0	24.0	12.0	14.5	Light Brown
6/20	3	1	0.00	CALM	CALM	14.0	22.0	13.0	15.5	Light Brown
6/21	3	1	0.00	CALM	SW-10	14.0	23.0	14.0	15.0	Light Brown
6/22	4	4	0.16	SW-10	SW-10	11.0	14.0	14.0	15.0	Light Brown
6/23	4	4	1.10	SE-10	CALM	14.0	14.0	12.0	12.5	Light Brown
6/24	4	4	0.14	Var	SW-5	8.0	14.0	12.0	13.0	Light Brown
6/25	4	4	Tr	CALM	SW-5	8.0	13.0	10.5	12.0	Light Brown
6/26	4	4	0.00	S-5	CALM	11.0	17.0	11.0	11.5	Light Brown
6/27	4	4	0.05	CALM	SW-15	11.0	12.0	11.0	11.0	Light Brown
6/28	4	4	0.33	SE-10	S-10	11.0	13.0	12.5	11.0	Light Brown
6/29	4	4	0.00	CALM	CALM	12.0	15.0	12.0	11.0	Light Brown
6/30	4	4	0.00	S-10	CALM	10.0	13.0	11.0	12.0	Light Brown

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Appendix B1.–Page 2 of 2.

Date	Cloud Cover <sup>a</sup>		Precipitation (mm)	Wind Direction & Velocity (k/hr)		Air Temperature (°C)		Water Temperature (°C)		Water Color
	800	2000		800	2000	800	2000	800	2000	
7/01	4	4	0.00	S-5	CALM	12.5	16.0	11.0	12.0	Light Brown
7/02	1	2	0.00	CALM	CALM	8.0	14.0	12.0	12.0	Light Brown
7/03	2	3	Tr	CALM	S-10	20.0	13.0	12.5	13.0	Light Brown
7/04	3	2	Tr	CALM	CALM	16.0	16.0	12.0	12.0	Light Brown
7/05	3	2	0.45	SW-5	SW-10	15.0	20.0	13.0	14.0	Light Brown
7/06	5	4	Tr	CALM	SW-5	11.0	18.0	12.5	14.0	Light Brown
7/07	3	3	0.00	CALM	CALM	12.0	24.0	13.0	15.0	Light Brown
7/08	4	4	0.28	S-5	S-5	13.0	15.0	13.5	14.0	Light Brown
7/09	3	1	Tr	CALM	SE-5	11.5	17.0	13.5	14.0	Light Brown
7/10	2	4	0.05	CALM	S-5	10.0	17.0	13.0	14.0	Light Brown
7/11	4	4	0.48	SE-5	S-5	11.0	14.0	12.5	14.0	Light Brown
7/12	4	1	Tr	S-5	S-10	11.0	19.0	12.0	14.0	Light Brown
7/13	4	4	0.00	S-5	S-5	12.0	14.0	13.0	14.0	Light Brown
7/14	4	4	0.05	CALM	S-5	12.0	16.0	13.0	13.0	Light Brown
7/15	4	4	0.00	CALM	SW-5	12.0	15.0	12.5	13.0	Light Brown
7/16	2	1	0.00	CALM	CALM	14.0	20.0	13.0	14.0	Light Brown
7/17	1	2	0.00	CALM	SW-5	13.0	19.0	13.0	15.0	Light Brown
7/18	4	4	0.25	CALM	CALM	12.5	20.0	14.0	15.0	Light Brown

Note: n = no observation.

<sup>a</sup> Cloud cover: 1 = cloud cover is less than 1/10 of sky, 2 = cloud cover not more than 1/2 of sky, 3 = cloud cover is more than 1/2 of sky, 4 = clouds completely cover the sky, 5 = fog or thick haze.